Northcentral Montana Cooperative Westslope Cutthroat Trout Restoration Project

2003 Annual Report

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ABSTRACT

There has been no appreciable change in miles of stream which support pure WCT populations or number of pure populations since 2002 in northcentral Montana. This is partly because some genetic results obtained in early 2003 were included in the 2002 report; these populations are discussed in more detail in this report. In addition, very few new genetic results have been received since spring of 2003. Decreases in miles of stream supporting pure WCT and number of populations of pure WCT is primarily a result of new genetic information. Since 2000, the number of 100% pure populations of WCT has decreased from 72 to 58 and the number of miles of stream has decreased from 194 to 141. These are 19% and 27% decreases, respectively. Since 2000, the number of 90-99.9% pure populations of WCT has increased from 43 to 60 and the number of miles of stream has increased from 168 to 209, representing 40% and 24% increases, respectively. Since 2000, the number of less than 90% pure populations of WCT has increased from 20 to 28 and the number of miles of stream has increased from 66 to 84 this is a 40% and 27% increase, respectively (Tables 1 and 2). In general, decreases in miles of stream and number of populations of pure fish are reflected in increases in miles of stream and populations of less than pure fish. Westslope cutthroat restoration activities in the Missouri River included piscicide treatment of over 8 miles of stream on Cottonwood Creek (Beartooth Game Range) in preparation for replacement with pure WCT. Restoration activities in the Arrow Creek drainage included continued suppression/eradication of WCT above a constructed barrier on Cottonwood Creek on the east side of the Highwood Mountains. During suppression, very few brook trout (8 individuals) were captured during 7 days of electrofishing. Suppression will continue until brook trout are eliminated from this drainage. Restoration activities in the Belt Creek drainage included identification of an opportunity for barrier construction and expansion of a pure WCT population in Crawford Creek; enhancement of a partial barrier (velocity) in Pilgrim Creek by anchoring boulders with rebar and epoxy; and continued suppression of EB in Middle Fork of Little Belt Creek using electrofishing. In addition, MFWP and USFS are currently investigating the possibility of replacing a culvert on Middle Fork Little Belt with a new culvert that is a barrier to EB. Restoration activities in the Highwood and Shonkin Creek drainages included brook trout suppression in Big Coulee Creek upstream of the barrier blasted out of bedrock in 2002; construction (USFS) of a drift fence on the west side of Big Coulee creek to protect riparian areas from cattle grazing; and drafting of new regulations closing the fishery on Big Coulee Creek. Restoration activities on the Rocky Mountain Front included, surveys of habitat and fishery resources in the upper Dupuyer and Cow Creek drainages and an additional transfer of 50 fish (50 were transferred in 2002) from Whiterock Creek (South Fork Two Medicine) to previously fishless habitat in Lonesome Creek (Badger Creek). Restoration activities in the Smith River involved transfer of 80 pure WCT from Cottonwood Creek (Castles) to 1.5 miles of empty habitat above a fish barrier on Middle Camas Creek (Big Belts), and a transfer of 200 fish from the North Fork of Deep Creek (Smith) to Petty Creek (Sun). The transfer to Petty Creek is the second in two years. Restoration activities in the Judith drainage included planning and collection of biological information related to a proposed transfer of pure fish to approximately 1.5 miles of fishless habitat in upper West Fork Cottonwood Creek (Snowy Mountains); fish population estimates on Dry Fork Creek; habitat and fish surveys of Weatherwax and Harrison creeks; surveys of East Fork Spring Creek prior to a planned transfer of pure WCT to North Fork Ford Creek (Rocky Mountain Front) in 2004; and completion of the Environmental Assessment for construction of a fish barrier on the SF Judith River near Bluff Mountain Creek. In addition to these accomplishments, numerous surveys of biotic and abiotic variables were completed throughout northcentral Montana.

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INTRODUCTION

Westslope cutthroat trout (WCT) were first described by Lewis and Clark in 1805 near Great Falls, Montana. WCT are recognized as one of 14 interior subspecies of cutthroat trout and are found in Alberta, Idaho, Washington and Montana. In Montana, WCT occupy the Upper Missouri River drainages east of the Continental Divide and the Upper Columbia Basin west of the divide (Behnke 1992). Although still widespread, WCT distribution and numbers have declined significantly in the past 100 years due to a variety of causes, including loss of habitat, competition and predation from non-native fish species, and hybridization (Shepard et al. 2003, Shepard et al. 1997, McIntyre and Rieman 1995, Liknes 1984, Hanzel 1959). Genetically unaltered WCT currently occupy approximately 8% of their historic habitat across their entire range (Shepard et al. 2003).

The marked decrease in WCT density and distribution led to them being listed in 1972 as a State Species of Special Concern by the Montana Department of Fish, Wildlife and Parks (MFWP). WCT were petitioned for listing as threatened under the federal Endangered Species Act in June 1997.

The state of Montana developed a statewide WCT Conservation Agreement in 1999, with the help of a technical committee formed in 1994 and a steering committee formed in 1996. The Conservation Agreement was signed by several state and federal agencies as well as some non-government organizations. In 2000, a document was developed which described the status and restoration strategies (SRS) necessary for restoration of WCT in northcentral Montana (Tews et al. 2000). The strategies in the SRS were based on goals and objectives developed in the Conservation Agreement.

Strategies for restoration of WCT in northcentral Montana outlined in the 2000 SRS included: 1) preservation of all existing pure populations, 2) creation of two large populations (>50 miles of stream) as proposed in the conservation agreement, and 3) establishment of 2 – 4 additional secure viable populations (minimum of 2,500 individuals) each, in the Southern Tributaries and the East Front. Tools available to implement these strategies include, creation of new barriers to protect pure populations, removal or eradication of non-native species, and replication of existing pure populations in either empty headwater habitats or habitats made empty through application of piscicides.

In April of 2000, following an extensive status review, the U.S. Fish and Wildlife Service (USFWS) determined that westslope cutthroat trout were “not warranted” for federal listing. That finding was challenged in federal court, and the court remanded the not warranted finding back to the USFWS for additional review. In 2003, after additional review, the USFWS determined that WCT are not likely to become a threatened or endangered species in the foreseeable future, therefore listing was not warranted.

In 2001, a challenge cost share agreement was established between MFWP and the United States Forest Service (USFS). The agreement was formed to help implement new restoration efforts for WCT in northcentral Montana and coordinate existing efforts described in the SRS. The Wildlife Conservation and Restoration Program (WCRP) and the State Wildlife Grants (SWG) programs were established to provide states with federal aid funding to conserve declining fish and wildlife and their habitats. These programs provided funding in 2002 and 2003. Pennsylvania Power and Light (PPL) provided funding for a fish and wildlife technician in 2003. This report and much of the WCT restoration work it includes is a direct result of funding from these programs.

This report describes the status of WCT in northcentral Montana relative to the status of WCT in 2000 (SRS) and presents data on individual streams organized by drainages or regions. Detailed data is included in several appendices.

STUDY AREA

The general study area includes the following drainages: Arrow, Belt, Highwood, Judith, Musselshell, Smith, Sun, Teton, Two Medicine, and Upper Missouri. These drainages are found within MFWP Region 4 and most WCT populations are located on National Forest Lands within Lewis and Clark and Helena National Forests (Figure 1).

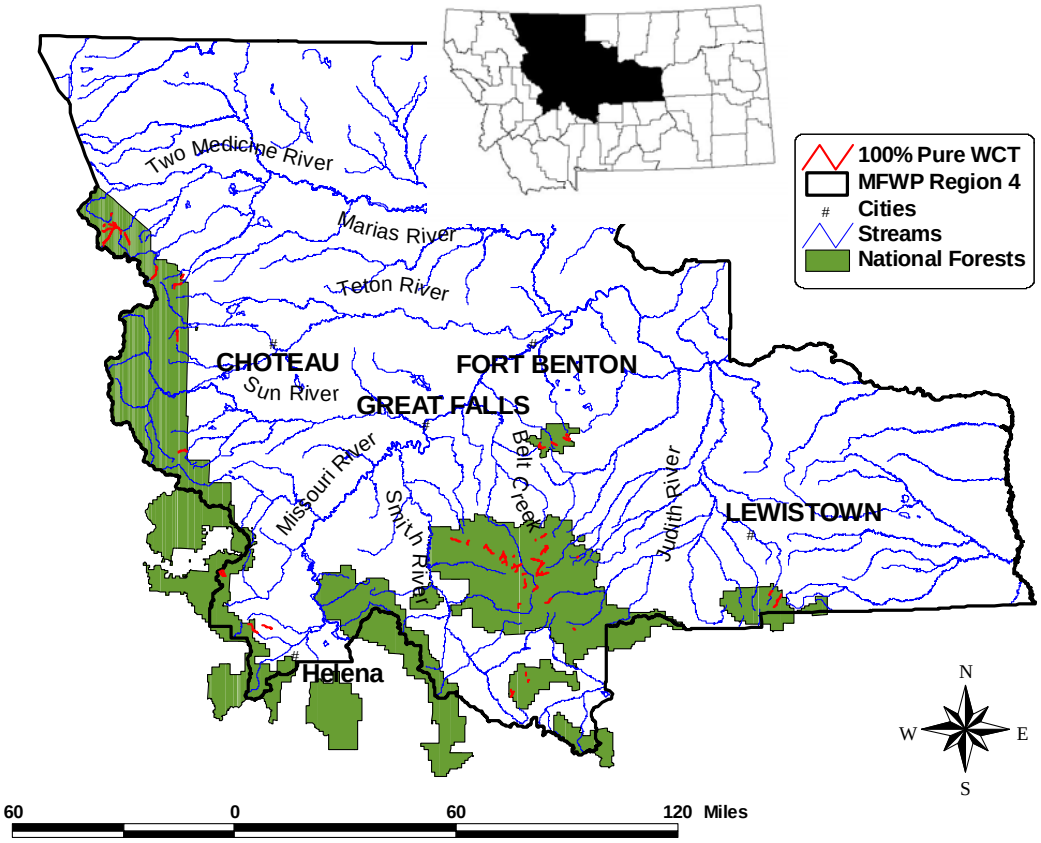


Figure 1. Study area in northcentral Montana with 100% pure WCT populations.

PROCEDURES

Fish populations were sampled with Smith Root Model 12-B and 12-A battery powered backpack electrofishing units. Population estimates followed the methods of Leathe (1983). On larger streams, two backpack units were used side by side to increase electrofishing efficiency. When the probability of capture during the second pass was less than 0.8, additional passes were made to reduce underestimates of trout population size as described by Riley and Fausch (1992). Small streams were electrofished in either an upstream direction (upstream and downstream block nets) or downstream direction (downstream block net). Depletion estimates were calculated using Microfish 3.0 (Van Deventer and Platts 1985). Caudal fins from cutthroat trout were clipped (hole punch size) for PINES PCR genetic analysis and preserved in 95% ethanol. Adipose fins were clipped on trout that were sampled for genetics to prevent re-sampling the same fish during future collections. Allozyme genetic samples were collected from the SF Judith River at two locations (25 fish each). On some streams, temperature was recorded every 1 – 2 hours with Onset continuous recording data loggers. Specific conductivity/TDS was measured with a temperature compensated Oakton TDSTestr3, TDSTestr1, or ECTestr with a range of 0 – 1990 μS/cm.

RESULTS AND DISCUSSION

Revision of WCT Distribution in Central Montana

Information within the 2000 SRS was used to guide restoration efforts over the last three years and provides a context with which to judge recent WCT restoration and protection efforts in northcentral Montana. It is important to stress that the purity and range of WCT populations described in the 2000 SRS was developed through professional judgment based on temporally and spatially limited sampling information. Moreover, estimated miles were in many cases developed by local biologists using maps and limited ground-truthing. The following results are presented as a rough estimate of WCT restoration progress in central Montana since 2000 (baseline), and 2002 (most recent reporting), it is not intended as a precise accounting of miles or purity.

There has been no appreciable change in miles of stream which support pure WCT populations or number of pure populations since 2002. This is partly because some genetic results obtained in early 2003 were included in the 2002 report; these populations are discussed in more detail in this report. In addition, very few new genetic results have been received since spring of 2003. Decreases in miles of stream supporting pure WCT and number of populations of pure WCT is primarily a result of new genetic information. Since 2000, the number of 100% pure populations of WCT has decreased from 72 to 58 and the number of miles of stream has decreased from 194 to 141, representing 19% and 27% decreases, respectively. Since 2000, the number of 90-99.9% pure populations of WCT has increased from 43 to 60 and the number of miles of stream has increased from 168 to 209, representing 40% and 24% increases, respectively. Since 2000, the number of less than 90% pure populations of WCT has

increased from 20 to 28 and the number of miles of stream has increased from 66 to 84, a 40% and 27% increase, respectively (Tables 1 and 2). In general, decreases in miles of stream and number of populations of pure fish are reflected in increases in miles of stream and populations of less than pure fish (Table 2). Appendices 1 through 5 show specifics related to changes in miles of stream and number of populations of pure WCT.

Table 1. Distribution of WCT, rainbow trout and brook trout (stream miles) in central Montana. Number of populations in parentheses (Tews et. al 2000; updated January 2004).

Drainage	Estimated miles of suitable historic habitat for WCT [1]	Miles of stream occupied by 100% pure WCT (# of pops.) [2]		Miles of stream occupied by 90-99.9% pure WCT (# of pops.) [2]		Miles of stream occupied by less than 90% pure WCT (# of pops.) [3]		Miles of stream occupied by brook trout [4]	Miles of stream occupied by rainbow trout [4]	Total stream miles in drainage [5]
Upper Missouri	1,199	12	(4)	3	(1)	16	(4)	802	992	2,200
Shonkin	21							21	14	
Highwood	55	2	(1)			1	(1)	55	44	
Smith	741	18	(9)	23	(8)	38	(10)	691	516	2,858
Sun	365	3	(1)	9	(5)	5	(1)	362	461	2,404
Belt	249	44	(21)	53	(13)	8	(5)	211	197	800
Teton	335	6	(3)	25	(9)			329	194	1,751
Two Medicine	267	37	(10)	41	(9)	9	(5)	240	194	1,422
Cutbank Cr.	23							0	23	1,089
Marias	150							0	150	2,494
Arrow	47	3	(2)					47	34	1,336
Judith	480	9	(5)	55	(15)	7	(2)	304	409	3,223
Upper Musselshell								262	198	4,676
Box Elder	94	2	(1)					0	94	891
Flatwillow	122	5	(1)					122	98	1,372
Total Region 4 2003	**4,148**	**141**	**(58)**	**209**	**(60)**	**84**	**(28)**	**3,446**	**3,618**	**26,516**
Total Region 4 2000	**4,148**	**194**	**(72)**	**168**	**(43)**	**66**	**(20)**	**3,446**	**3,618**	**26,516**

[1] suitable habitat based on current rainbow and brook trout distribution in the historical WCT range (Steve Carson, MFWP, Montana Rivers Information System)

[2] calculated from USFS and MFWP data files. Number of populations may vary slightly due to questions about where one population ends and another begins, updated 2003.

[3] genetically tested populations, 100's of more miles likely exist that have not been tested;

[4] miles from Montana Rivers Information System (Steve Carson, MFWP) and includes areas that were likely not historic habitat

[5] total drainage miles from Conservation Agreement (MFWP 1999), this number includes stream reaches that have not been surveyed, including areas that will not support trout

[6] from USFWS 1999

Table 2. Percent change in stream miles with 100%, 90-99.9%, and <90% WCT between 2000 and 2003. Blanks indicate no data but suspect no WCT are present. A plus sign means there were no pure fish present in 2000 so percent change could not be calculated. Percent change in number of populations in parentheses.

Drainage	Percent change since 2000 in miles of stream with 100% pure WCT (# of pops.)		Percent change since 2000 in miles of stream with 90-99.9% pure WCT (# of pops.)		Percent change since 2000 in miles of stream with 90% pure WCT (# of pops.)	
Upper Missouri	-40%	(-20%)	0%	(0%)	100%	(33%)
Shonkin						
Highwood	-33%	(-50%)				
Smith	-10%	(13%)	5%	(14%)	36%	(43%)
Sun	+	+	0%	(-17%)	0%	(0%)
Belt	-21%	(-16%)	33%	(86%)	0%	(25%)
Teton	-40%	(-50%)	19%	(80%)		
Two Medicine	-12%	(-9%)	8%	(-10%)	-10%	(67%)
Cutbank Cr.						
Marias						
Arrow	0%	(0%)				
Judith	-73%	(-55%)	57%	(114%)	0%	(0%)
Upper Musselshell						
Box Elder	0%	(0%)				
Flatwillow	0%	(0%)				
Total Region 4	**-27%**	**(-19%)**	**24%**	**(40%)**	**27%**	**(40%)**

Most of the major changes in status of local populations are described and listed in Appendix 4, these include, changes because of new information from upstream sites, adjustments in map distance, distance changes because of new upstream genetic data, possible extinctions, and unsuccessful transfers (replication) of populations to empty habitats. In addition, more textual detail is provided in the summary of survey and restoration efforts forthwith.

Restoration Projects, 2003

The following tables and text present the highlights of recovery efforts during 2003. Specifics related to recovery efforts and biological monitoring from 2000 to 2001 SRS have been presented in MFWP annual coldwater reports (Tews et al. 1999 and 2000; Tews et al. 2001).

In general, recovery efforts involve use of the following methodologies: 1) creation of fish barriers, 2) brook trout suppression/eradication, and 3) WCT transfers (replication or expansion opportunities). These methodologies were outlined in the 2000 SRS (Tews et al. 2000) as well as the 1999 Memorandum of Understanding and Conservation Agreement (MFWP 1999). These efforts focus on protecting existing

pure populations through creation of barriers to upstream movement of non-native fishes, maintaining status quo of populations by suppression of non-native fishes, and increasing the range of pure populations through transfer to headwater habitats devoid of fishes or into habitats where non-native fish have been removed by use of piscicides. A decision was made not to suppress non-native brook trout in streams where WCT have introgressed (90-99.9%) with rainbow trout. This decision was made necessary because of limited resources and the presence of numerous populations of pure cutthroat threatened by brook trout. If additional resources become available, efforts to suppress brook trout in nearly pure populations of WCT may be initiated.

In addition to the aforementioned restoration efforts, collection of baseline and monitoring information is integral to evaluation of success of projects and modification of future restoration methodologies. Information collected in 2003 included: 1) fish abundance and biomass, 2) instream habitat quality and quantity, 3) stream temperature and conductivity, 3) invertebrate samples, amphibian surveys, and fish disease collections (for transfers), and 4) fish population genetic samples.

Summary of Survey and Restoration Efforts by Drainage

Statistics of fish sampled during 2003 are listed in Appendix 6. Streams were sampled by USFS, MFWP, and USFWS crews. Genetic test results from prior years sampling were received from 24 streams (Appendix 7). In 2003, MFWP, USFS and USFWS personnel took tissue from *Oncorhynchus* sp. for genetic testing on about 22 streams region-wide (Appendix 8). Information on specific conductance or total dissolved solids was collected at all fish sampling locations (Appendix 9).

Upper Missouri River Drainage

Major WCT restoration accomplishments in the upper Missouri River include, piscicide treatment of over 8 miles of stream on Cottonwood Creek.

Cottonwood Creek In 2003, two piscicide treatments were completed on Cottonwood Creek using rotenone. Two brook trout were found during electrofishing surveys after treatment. Surviving brook trout likely evaded the piscicide plume by finding refuge in springs near or in the stream channel.

Elkhorn Creek Genetic samples collected in 2002 (46 PCR) and analyzed in 2003 revealed that Elkhorn Creek fish were no longer pure; WCT 87.6% x 12.4% rainbow trout (RBT). Elkhorn Creek was thought to be a pure stronghold of fish protected by a gabion barrier constructed in the early 1970's. The genetic results (pattern of alleles) indicate that the introgression was recent.

Skelly Gulch Genetic samples collected in 2002 (39 PCR) and analyzed in 2003 confirmed that Skelly Gulch contains pure WCT (Cook 2003).

Arrow Creek Drainage

Major accomplishments related to WCT restoration in the Arrow Creek drainage include continued suppression/eradication of EB above a constructed barrier on Cottonwood Creek on the east side of the Highwood Mountains. Very few brook trout (8) were captured during 7 days of electrofishing. Suppression will continue until brook trout are eliminated from this drainage (Figure 2).

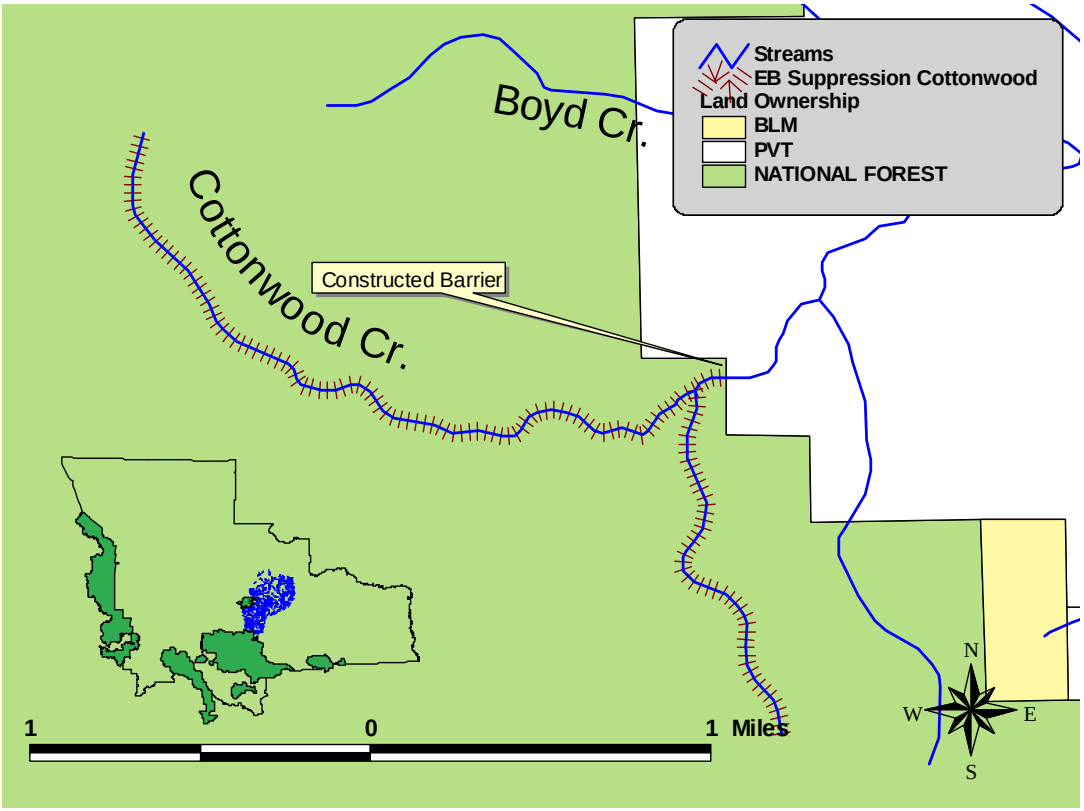


Figure 2. Work done in 2003 in Arrow Creek drainage.

Cottonwood Creek Crews from MFWP and USFS removed brook trout from above a fish barrier (constructed 2001) on three occasions in 2003 (August 11-14, August 18, and September 29 to October 1). Two to three crews using backpack electrofishing units made two passes in areas below a natural barrier and above the constructed barrier and one pass upstream of the natural barrier. Eight brook trout (EB) were removed during all sampling periods. Though few EB were found, they were distributed along the entire length of Cottonwood Creek. Suppression of brook trout will continue annually to bi-annually until they are eliminated from the protected area above the barrier on Cottonwood Creek (Shepard and Nelson *in preparation*). Genetic samples collected (15 PCR) in 2001 and analyzed in 2003 confirmed that Cottonwood Creek fish are pure WCT. A separate report will detail changes in the Cottonwood Creek fishery since suppression efforts and barrier construction (Shepard et al. *in preparation*).

Belt Creek Drainage

Major accomplishments related to WCT restoration in the Belt Creek drainage included identification of an opportunity for barrier construction and expansion of a pure WCT population in Crawford Creek; enhancement of a partial barrier (velocity) in Pilgrim Creek by anchoring boulders with rebar and epoxy; and continued suppression of EB in Middle Fork of Little Belt Creek using electrofishing. In addition, MFWP and USFS are currently investigating the possibility of replacing a culvert on Middle Fork Little Belt with a new culvert that is a barrier to EB (Figures 3 and 4 - Middle Fork Little Belt not shown).

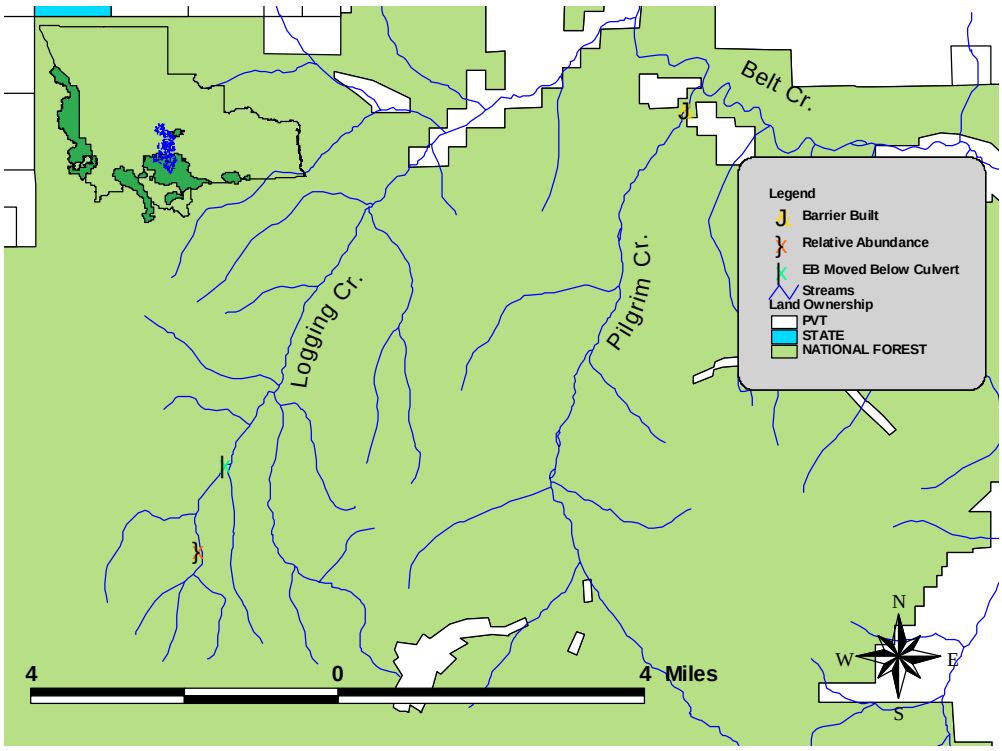


Figure 3. Work done in lower Belt Creek in 2003

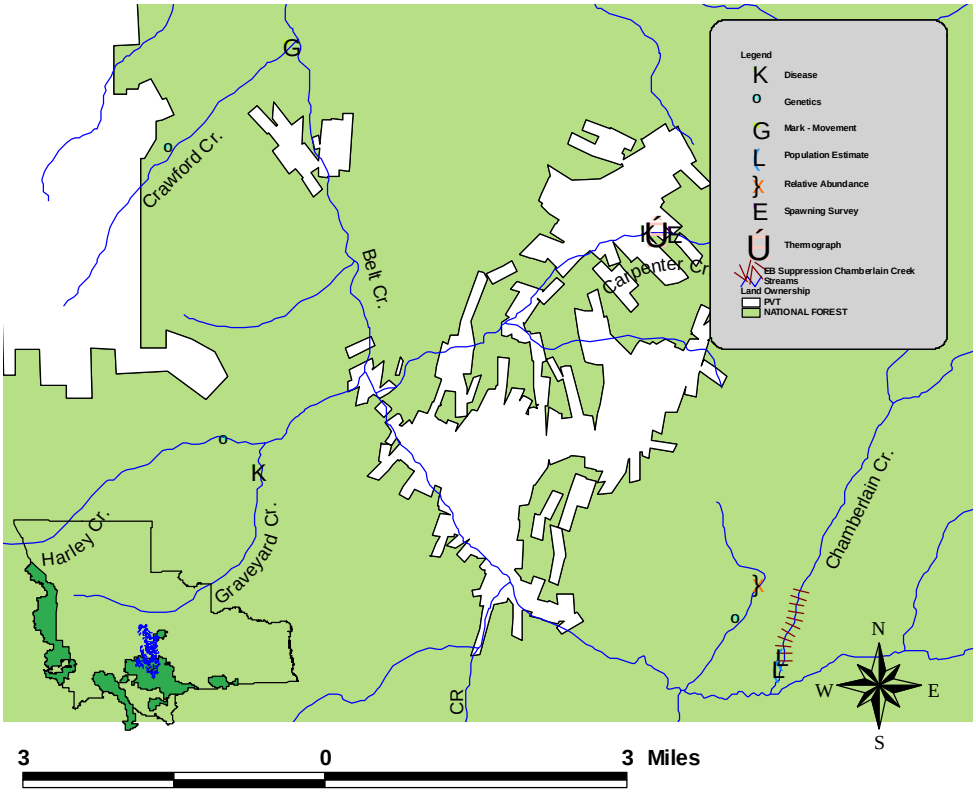


Figure 4. Work done in upper Belt Creek in 2003

Bender Creek Genetic samples collected in 2002 (25 PCR) and analyzed in 2003 revealed that Bender Creek fish are pure WCT. This population is isolated, unprotected by barriers, and very small (Cook 2003) (Appendix 7).

Carpenter Creek Spawning surveys were completed on Carpenter Creek on three occasions in 2003 (June 3, 17, and 25). Surveys were conducted to determine if spawners could be accessed for collection of gametes for transfer using remote site incubators. Ripe fish in Carpenter Creek were very difficult to capture because of gradient and spring snowmelt. In addition, spawning gravels consist of difficult to find, small isolated patches. Movement of adults from Carpenter Creek is likely a more viable alternative than gamete collection. On August 26, 30 WCT were collected from Carpenter Creek for disease testing. Genetic samples collected (10 Allozyme) in 2000 from Carpenter Creek were analyzed in 2003. Results confirmed the purity of the Carpenter Creek population (Leary 2003) (Appendix 6 and 7).

Chamberlain Creek On August 20, 2003, two crews from the USFS and MFWP obtained population estimates at two sites on Chamberlain Creek (both upstream of the old bridge fish barrier). The lower site is approximately 1,300 ft. above the old barrier. The upper site is immediately upstream of the new fish barrier constructed during summer, 2002. The lower and upper sites had 64 and 91 WCT > three inches/1000 ft., respectively. The lower site had 18 EB > three inches/1000 ft. (Table 3). The increase in EB represents the movement of new individuals upstream after removal of the old

barrier (replacement of bridge). WCT numbers decreased at the lower site and increased at the upper site since 2002 (91/1000 ft.; lower and 89/1000 ft.; upper), 2001 (113/1000 ft.; lower and 128/1000 ft.; upper), 2000 (177/1000 ft.; lower), and 1999 (201/1000 ft.; lower)(Figure 5). On August 21, approximately 3,400 ft. of stream upstream of the new barrier was spot shocked for EB. Two EB were observed. It is likely that EB will persist in low numbers in Chamberlain Creek for many years. Continued annual collection of population and relative abundance data will be necessary to determine if intensive EB eradication efforts will be feasible or necessary (Shepard and Nelson, *in preparation*). Recent decreases in WCT numbers are most likely due to drought (Figure 5).

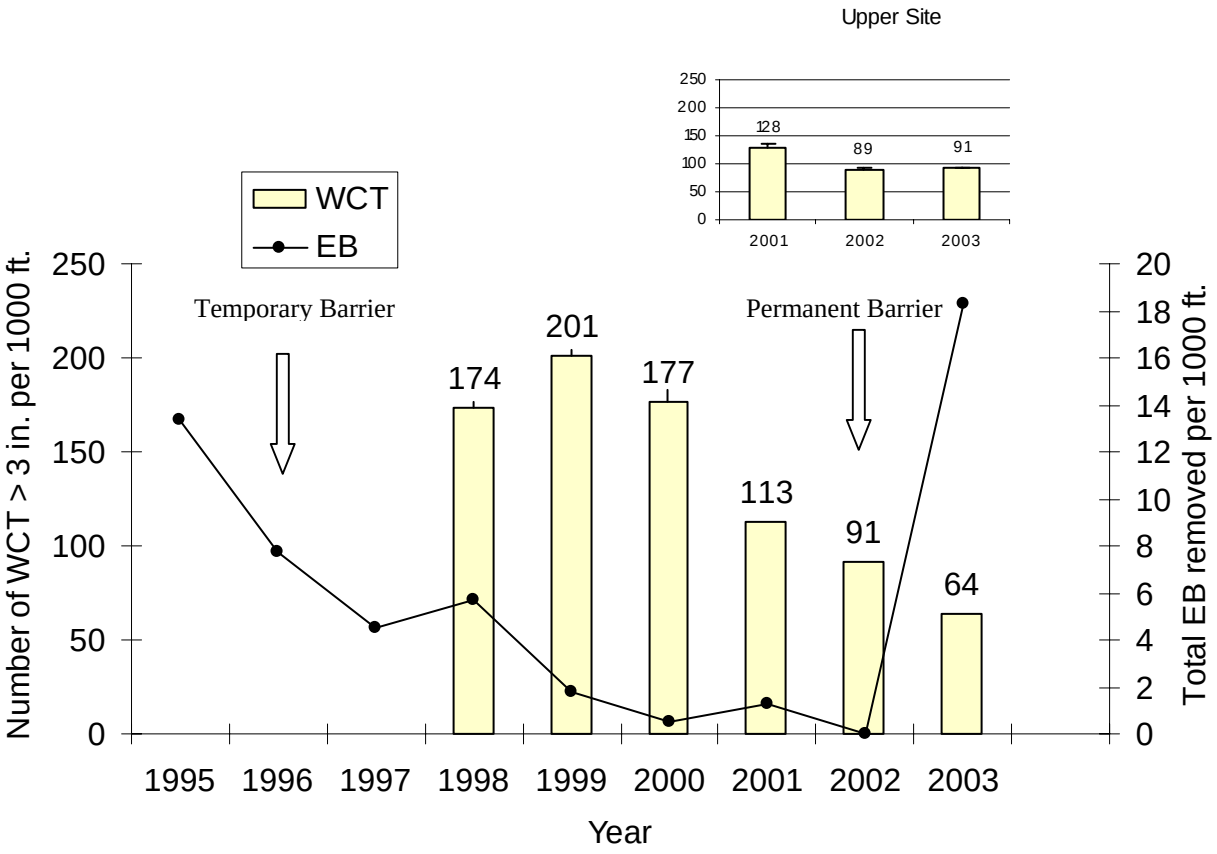


Figure 5. Abundance of WCT in Chamberlain Creek from 1995-2003 at upper and lower population monitoring sites. Estimates were obtained using the maximum-likelihood method.

Crawford Creek On May 8, 2003, 16 fish were marked below a concrete diversion structure on Crawford Creek near the Belt Creek Ranger Station. The fish were marked to determine if the structure was a barrier during spring flows (Appendix 6). Approximately 100 feet upstream of the concrete structure is a natural constriction in the stream channel that could be used in construction of a future fish barrier. In 2003, genetic samples (10 PCR) taken in 2001 upstream of several barriers at the headwaters of Crawford Creek came back as pure WCT (Cook 2003) (Appendix 7). Additional samples were collected on June 11, 2003 above (25) and below (15) the barriers to

determine if these fish are pure and the barriers function at all flows. If the WCT population is found to be pure, Crawford would provide and excellent range expansion opportunity in the Belt Creek drainage. After construction of a barrier, piscicides would be used to remove non-natives and the stream would be allowed to recolonize from pure fish upstream.

Graveyard Gulch On August 26, 2003, 65 fish (10 WCT, 33 HYB, and 22 EB were collected for disease testing (Appendix 6 and 8). A suitable recipient stream for Graveyard fish has not yet been identified. Genetic samples collected in 1999 (25 Allozyme) and analyzed in 2003 confirmed that Graveyard Gulch fish are pure WCT (Leary 2003) (Appendix 7).

Harley Creek On June 25, 2003, fin clips were taken from 25 WCT for genetic testing (PCR)(Appendix 6 and 8). Lower Harley Creek is currently a hybrid swarm, upper Harley Creek and it's tributary have been tested as pure WCT. The sample collected in 2003 is from an intermediate site and will provide information on purity of WCT in an unprotected, yet cold and ecologically sound stream.

James Creek Genetic samples (10 PCR) collected in 2001 and analyzed in 2003 revealed that James Creek fish are hybridized with RBT (95.7% WCT x 4.3% RBT)(Cook 2003)(Appendix 7).

Middle Fork Little Belt Creek Brook trout were removed from the Middle Fork of Little Belt Creek on July 1 and August 18-19, 2003 (Appendix 6). 87 EB were removed during suppression. Suppression in the Middle Fork is part of an ongoing effort to relieve non-native trout pressure on a pure WCT population partially protected by a beaver dam complex and culvert. Suppression efforts appear to be helping WCT maintain a foothold in the Middle Fork Little Belt Creek (Figure 6) despite relatively rapid recolonization of all age classes of EB along the entire length of WCT inhabited stream (Figure 7). Suppression efforts will continue until a permanent barrier is constructed in the drainage. Analysis by USFS engineers was completed on the feasibility of replacing the old failing culvert with a new culvert engineered to be a barrier to fish passage. Alternatives for creating a barrier culvert are currently being investigated. Genetic results from samples collected in 2001 (15 PCR) confirmed that Middle Fork Little Belt fish remain pure despite the lack of barriers to upstream migration of non-natives (Cook 2003) (Appendix 7).

Logging Creek On June 26, 2003, 65 EB were moved below a culvert on Logging Creek (Appendix 6). In addition, a short section of logging creek was surveyed approximately 0.5 miles upstream of the EB removal site. Low densities of WCT and no EB were found at the upstream site.

Lost Creek Genetic results from samples collected in 2002 (49 PCR) indicate that the Lost Creek population is not pure (5.5% YCT) (Cook 2003)(Appendix 7). These fish were thought to be pure because of isolation by a waterfall barrier and dry stream channel. Lost Creek fish were probably moved (legally or illegally) to their present location as hybridized fish (since there are no records of fish being stocked in this area).

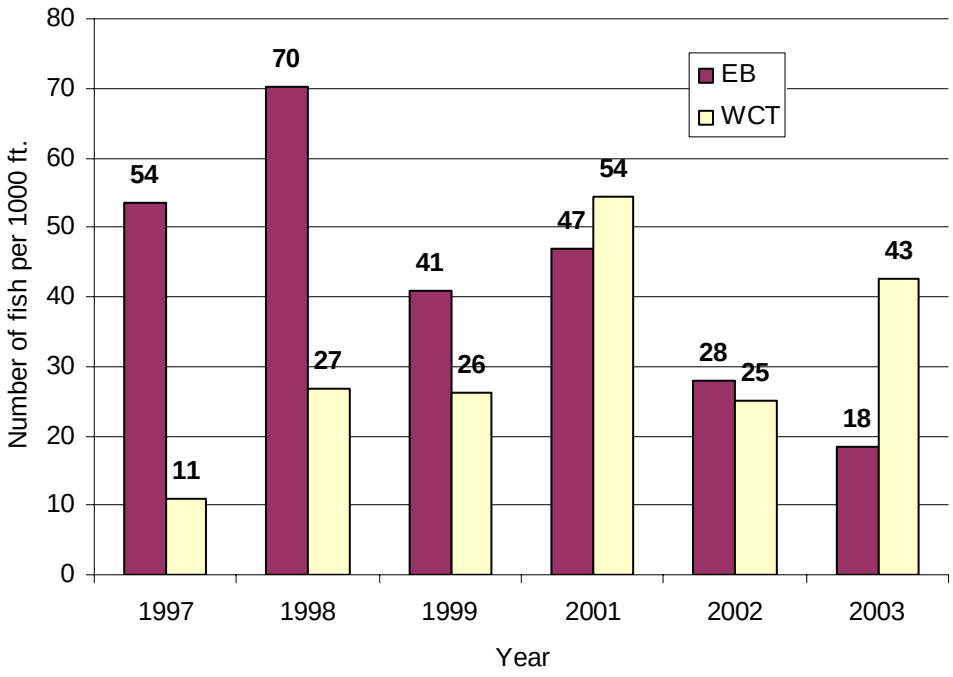


Figure 6. Relative abundance of all WCT and EB (all sizes) captured in the Middle Fork of Belt Creek. Numbers above bars are relative abundance of all fish caught during suppression efforts normalized to fish/1000 ft. Suppression efforts began in 1997.

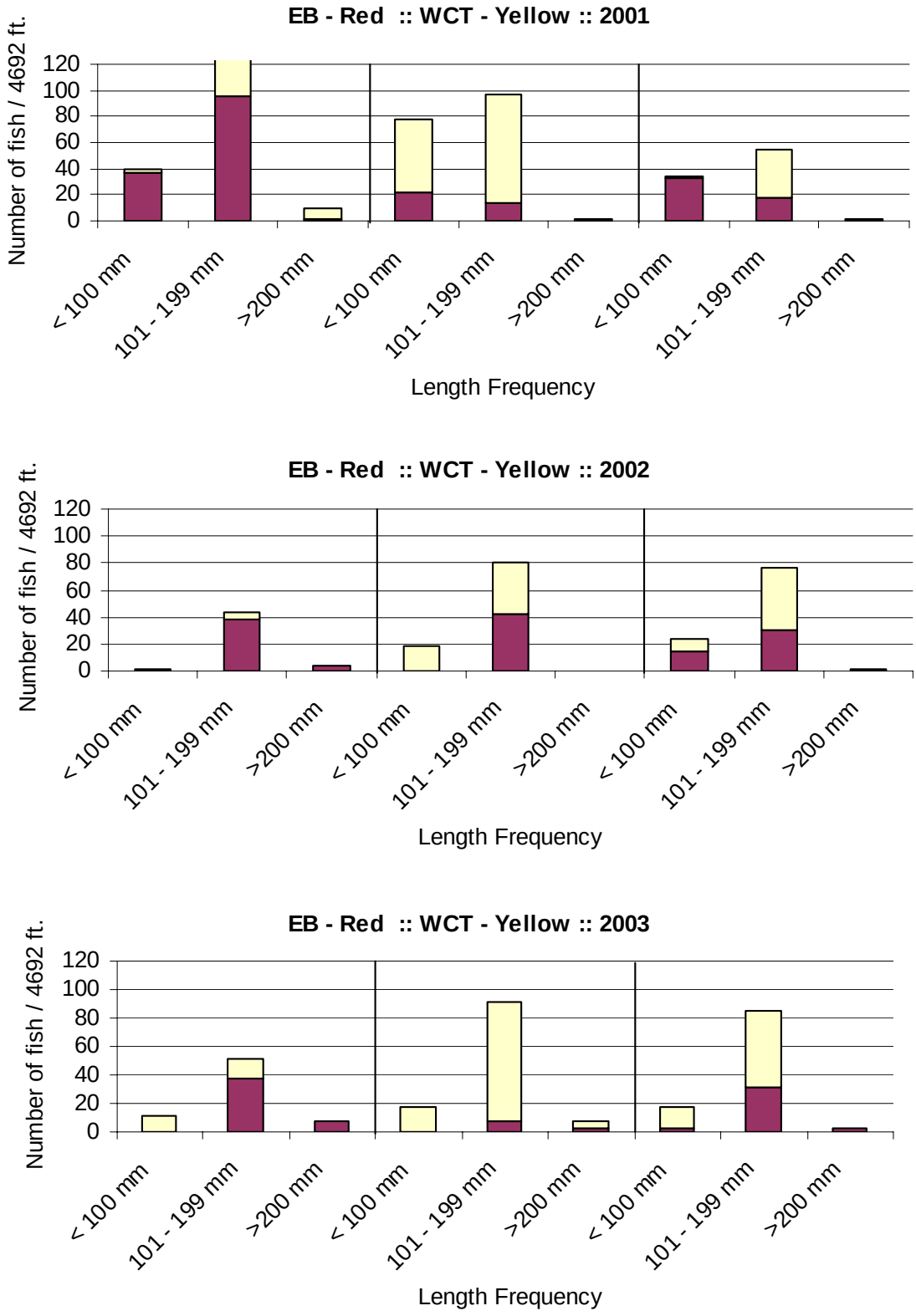


Figure 7. Length frequency of all WCT and EB captured in the Middle Fork of Belt Creek from 2001 to 2003. Each sub-plot from left to right (upstream direction) represents approximately a third of the shocked stream.

Palisades Creek Palisades Creek was surveyed for the presence of WCT on June 19, 2003. The stream was spot shocked until the upper end of fish habitat (Appendix 6). The majority of fish found were heavily hybridized WCT. Several of the fish found near the headwaters of Palisades Creek had physical characteristics typical of rainbow trout. 10 genetic samples were collected (Appendix 8). There are several opportunities for barrier construction at the mouth of Palisades Creek.

Pilgrim Creek On September 11, 2003, USFS and MFWP personnel constructed a barrier approximately one half mile upstream of the confluence of Pilgrim Creek and Belt Creek. The barrier was constructed using locally obtained rectangular boulders, a gas powered rotary hammer drill, ½ inch rebar, and epoxy. Two 35-inch boulders were anchored perpendicular to the stream channel directly upstream of a partial velocity barrier created by a natural chute of bedrock. The boulders were backfilled with angular rocks, gravel and sand. The new barrier is a complex, consisting of a 3-foot drop onto a chute (Figures 8 and 9). There are currently low levels of hybridization in Pilgrim Creek, either from historic passage of large rainbows over the natural barrier or past stocking efforts. The new barrier should prevent any further upstream movement of large rainbows or browns.

Figure 8. Pilgrim Creek barrier during construction.

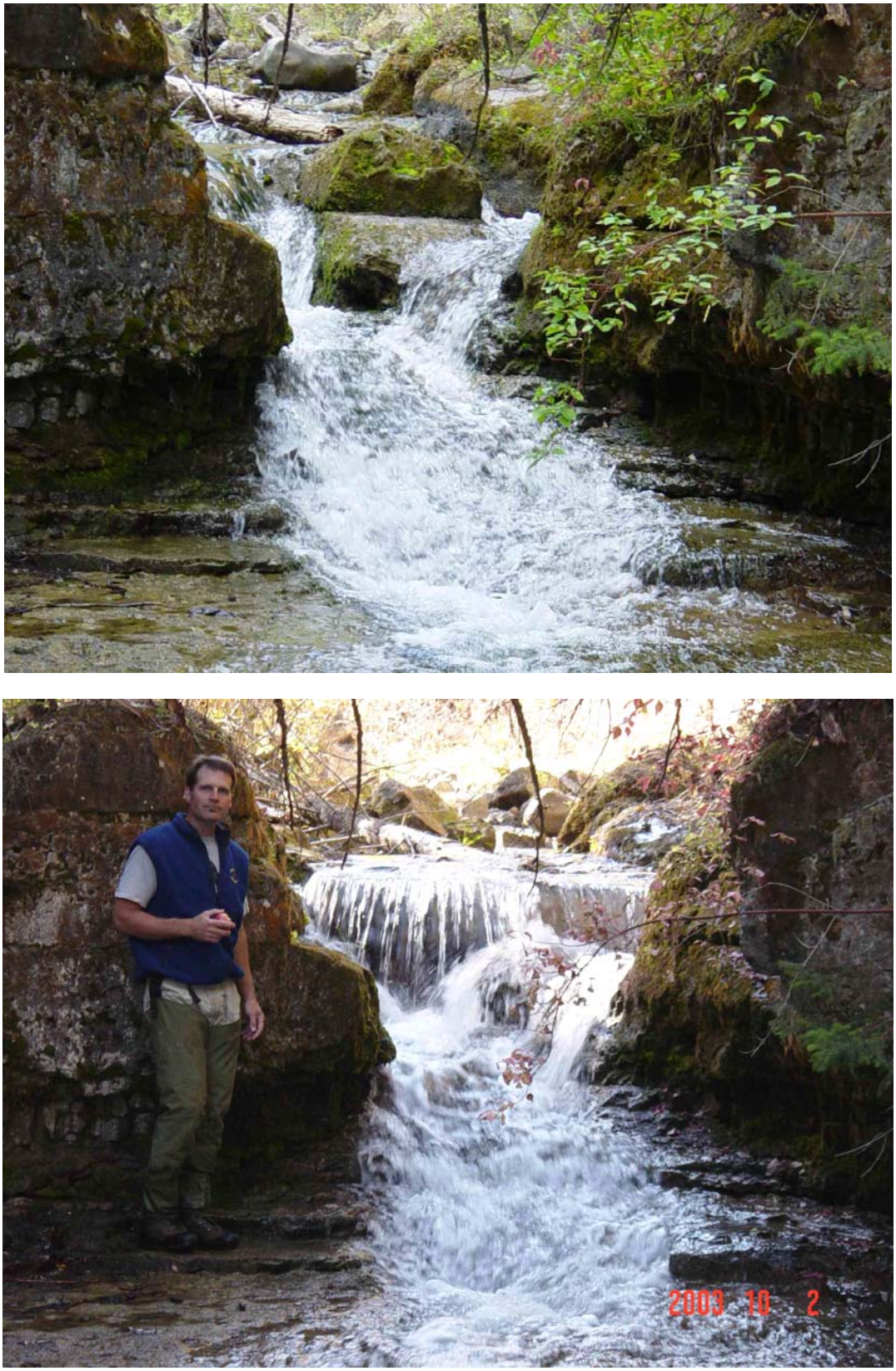


Figure 9. Natural barrier (velocity chute) before modification (upper photograph) and barrier after modification (lower photograph).

Highwood and Shonkin Creek Drainages

Major accomplishments related to WCT restoration in the Highwood and Shonkin Creek drainages included, brook trout suppression in Big Coulee Creek upstream of the barrier blasted out of bedrock in 2002. The USFS constructed a drift fence on the west side of Big Coulee creek to protect riparian areas from cattle grazing. Finally, new regulations were enacted which closed the fishery on Big Coulee Creek (Figure 10).

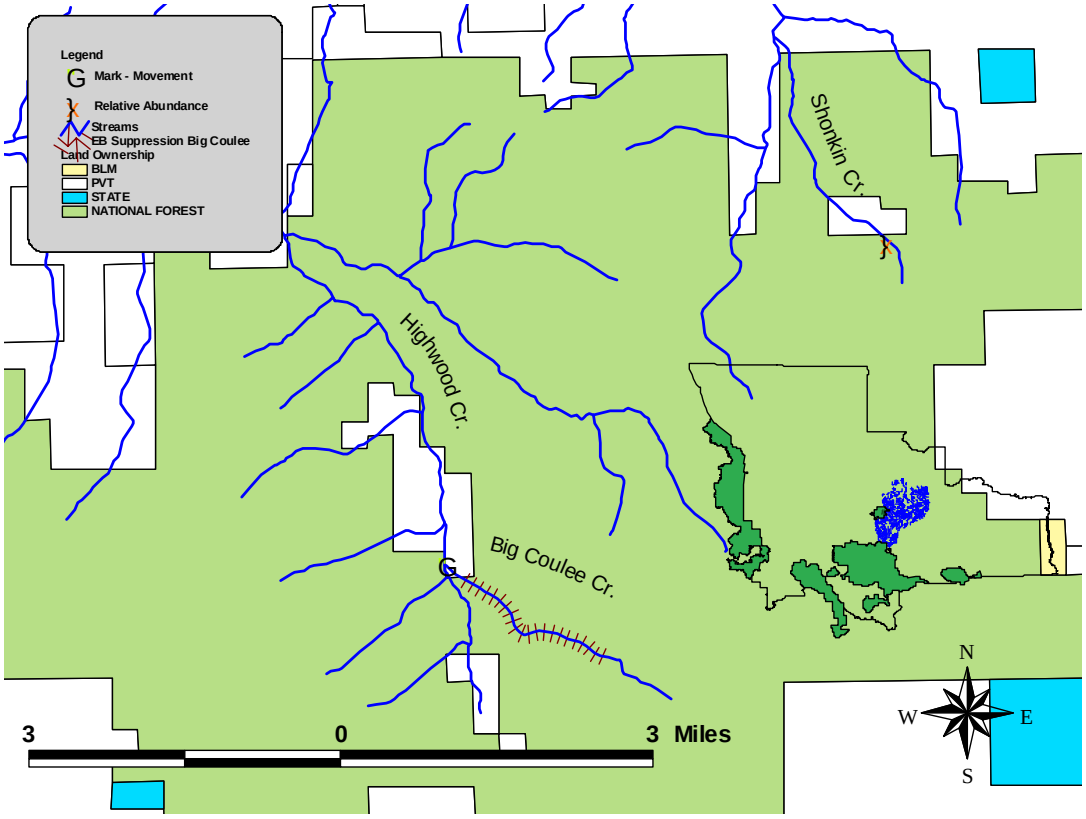


Figure 10. Work done in Highwood drainage in 2003.

Big Coulee Creek Numbers of westslope cutthroat have decreased dramatically in Big Coulee Creek the last three years. Figure 11 shows relative abundance of WCT and brook trout in Big Coulee from 1997-2003. Figure 12 shows length frequencies of WCT and EB in an upstream direction (from new barrier site) in 2002 and 2003. The new barrier was blasted approximately two months after suppression efforts in 2002. Some of the fish removed in 2003 were likely new colonists that immigrated during the two months between suppression in 2002 and barrier construction. However, there is a possibility that some fish passed the barrier during high flows in spring of 2003. Numbers of fish less than 100 mm in section three increased and all size classes of

WCT increased in the uppermost section from 2002 to 2003. On several occasions in 2003, EB were marked downstream of the new barrier blasted in 2002. Marked individuals found above the barrier in 2004 will give a qualitative estimate of barrier effectiveness against EB passage. Negative effects of drought, competition with brook trout, and grazing have put the last population of WCT in the Highwood drainage in peril. In addition, some illegal harvest of WCT may be occurring at a hunting camp near the upper barrier on Big Coulee Creek. Brook trout were removed from Big Coulee Creek over 10 days from June 10 to August 27, 2003 (Appendix 6 and Figure 12). Sections above the campsite barrier were shocked twice in two days. On the second day WCT were kept in live cars during removals. All other reaches were shocked once. If the barrier is not 100% effective, additional blasting may be necessary. In 2003, the USFS, Judith Ranger District, erected a drift fence on the west side of Big Coulee Creek to reduce grazing impacts. Additionally, MFWP enacted new regulations closing Big Coulee to fishing. It is hoped these measures will help maintain the WCT population in Big Coulee until drought conditions improve. Genetic samples (40 PCR) taken in 2002 and analyzed in 2003 upstream of the campsite barrier in Big Coulee Creek confirmed Big Coulee fish are pure WCT (Cook 2003).

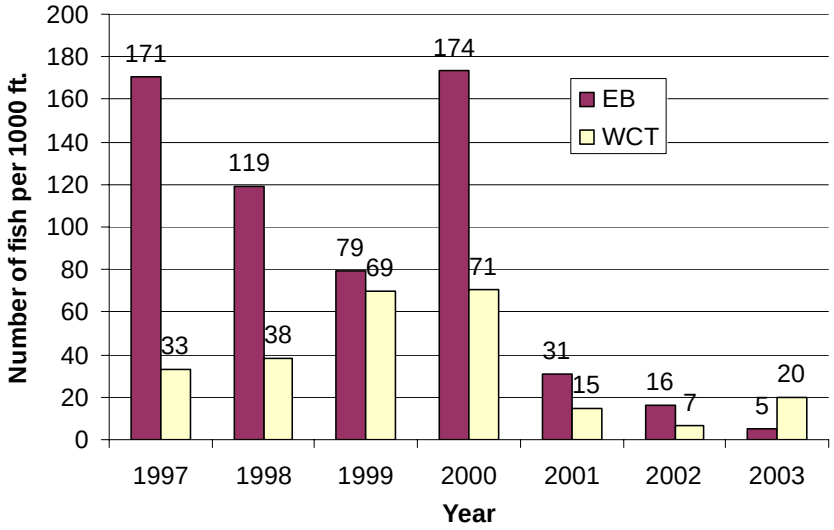


Figure 11. Relative abundance of all WCT and EB (all sizes) captured in Big Coulee Creek. Numbers above bars are relative abundance of all fish caught during suppression efforts normalized to fish/1000 ft. Suppression efforts began in 1997.

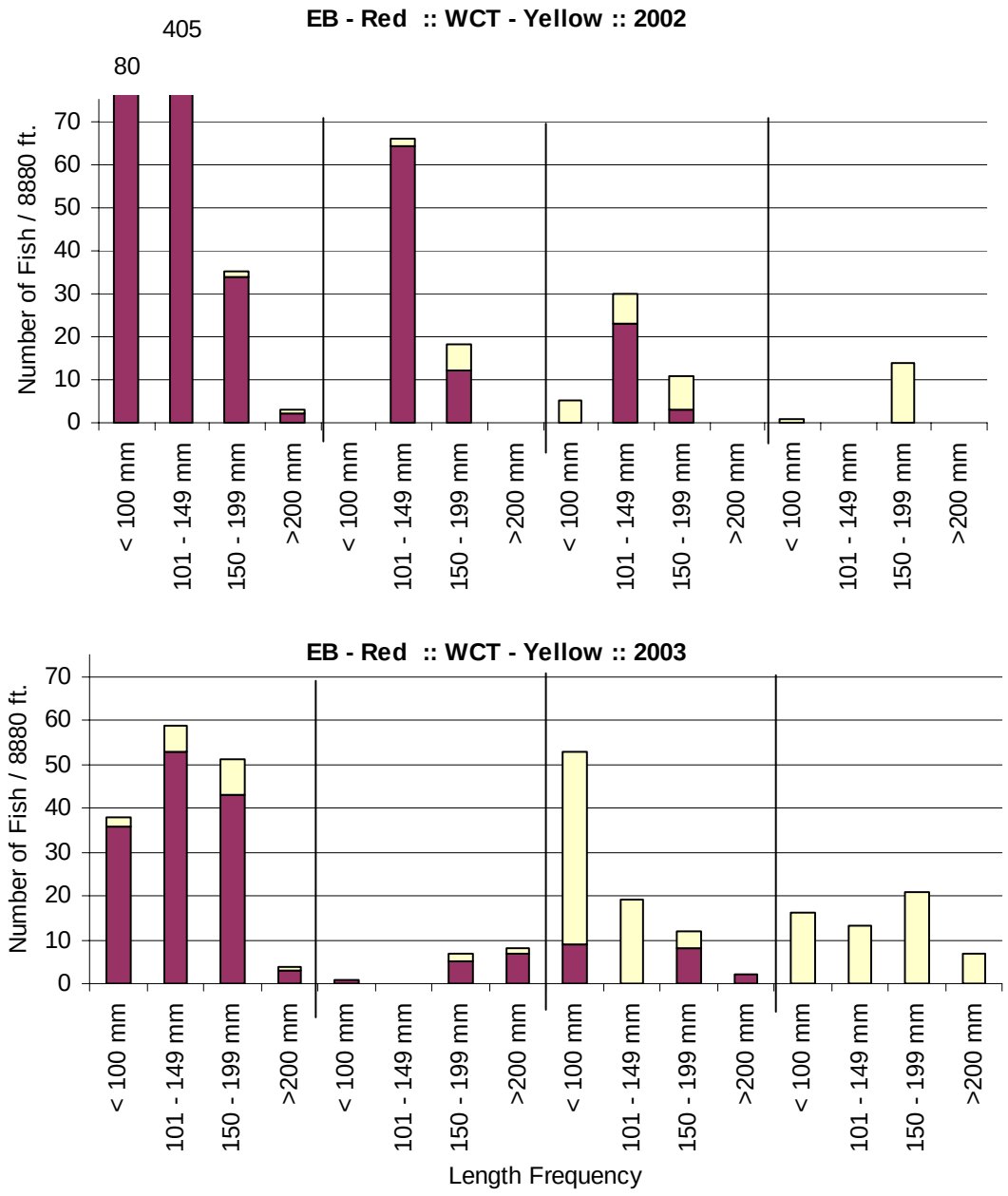


Figure 12. Length frequency of all WCT and EB (all sizes) captured in Big Coulee Creek 2002 and 2003. Each sub-plot from left to right (upstream direction) represents approximately a quarter of the shocked stream. The first sub-plot is below barrier.

Shonkin Creek On September 2, 2003, the headwaters of Shonkin Creek were surveyed for the presence of WCT (Appendix 6). Upper Shonkin supported high densities of EB in a paucity of habitat. The end of EB inhabited stream was found upstream of private inholdings on national forest.

Rocky Mountain Front Drainages

Major accomplishments related to WCT restoration on the Rocky Mountain Front included surveys of habitat and fishery resources in the upper Dupuyer and Cow Creek drainages; an additional transfer of 50 fish (50 were transferred in 2002) from Whiterock Creek (South Fork Two Medicine) to previously fishless habitat in Lonesome Creek (Badger Creek); and a transfer of 200 fish from the North Fork of Deep Creek (Smith) to Petty Creek (Sun). The transfer to Petty Creek is the second in two years (Figures 13, 14, and Appendix 10).

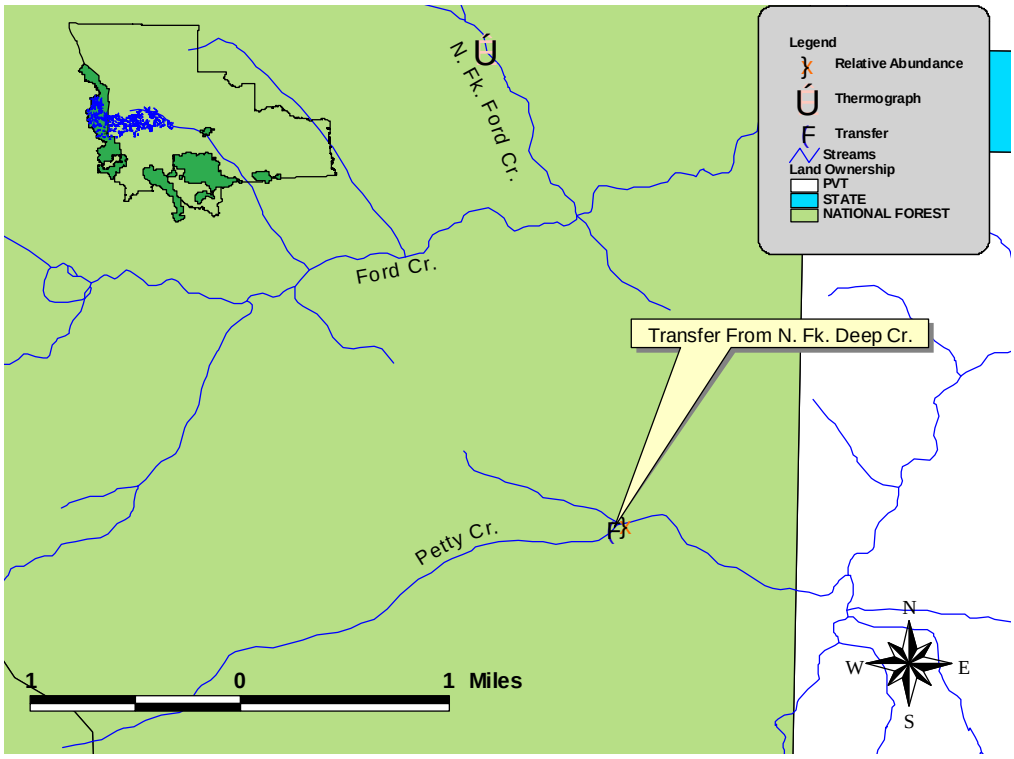


Figure 13. Work done in Sun drainage in 2003.

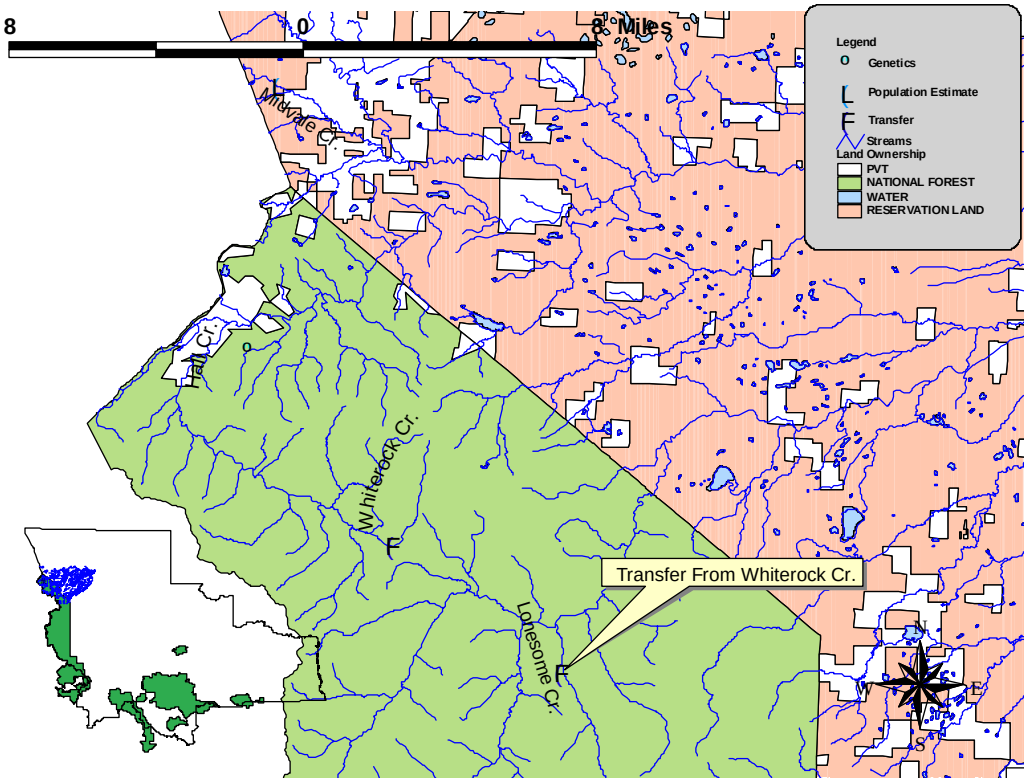


Figure 14. Work done in Two Medicine drainage in 2003. Dupuyer survey results are included in Appendix 10.

Upper Dupuyer Creek, North Fork Dupuyer Creek, Middle Fork Dupuyer Creek, South Fork Dupuyer Creek, and Cow Creek, Teton Drainage Information on fisheries resources and habitat variables were collected from these streams over a two-week period (July 14 to 24, 2003). Information was collected for future development of the Blackleaf Oil and Gas Draft Environmental Impact Statement. The complete report and findings are attached as Appendix 10. Westslope cutthroat trout (WCT) were widely distributed in the upper reaches of the South Fork (SF) and the North Fork (NF) Dupuyer creeks. WCT were not found in the lower reaches of NF Dupuyer Creek and at three sites in Dupuyer Creek (one large WCT adult was found at km 2.7 of Dupuyer Creek). In the middle reaches of the NF, WCT were found in low numbers in sympatry with brook trout (EB). WCT in sympatry with other species always had the largest individuals. In the upper reaches of the NF, where brook trout were not present, numbers of WCT exceeded 25 fish per 100 m of stream. In SF Dupuyer, WCT in allopatry were widely distributed and abundant (6-19 fish per 100 m of stream; average = 14.6). The Middle Fork (MF) of Dupuyer supported a small and localized population of WCT. MF fishes are likely heavily reliant, especially in drought years, on an irrigation diversion pond for over-wintering and late summer habitat. Populations of WCT in all three streams are protected from non-native fishes (in part in the NF) by physical barriers. Brook trout in allopatry were abundant in Dupuyer and the lower sections of the NF. In the middle reaches of the NF, both EB and WCT in sympatry were found in low numbers (combined totals less than totals of either EB or WCT at upstream and downstream sites in allopatry). Rainbow trout (RBT) were found in the

two lower most sections sampled in Dupuyer Creek. All RBT captured were large individuals. No WCT were captured at any of the sampling sites in Cow Creek. In 2000, Cow Creek supported a small population of nearly pure WCT. It is not known whether the WCT population in Cow Creek is extinct or we were just unsuccessful in locating individuals. Stream temperatures exceeded 20C on numerous occasions in Dupuyer Creek during July and August. Stream temperatures exceeded 20C on numerous occasions in Cow Creek during July. Stream temperatures in NF, MF and SF Dupuyer creeks were generally below levels stressful to salmonids. Stream habitat surveys indicated habitat quality was variable and site specific. Qualitative assessments of stream habitat referenced against other small stream habitats found throughout the Rocky Mountains tended to produce low habitat scores. Rocky Mountain Front streams appear to be less productive and have a flashier hydrologic regime than other streams in the Rocky Mountains west of the continental divide. Thus, low qualitative scores and low quantitative measures (e.g. pool frequency) in most cases are more a result of local geology and climate than anthropogenic influences. However, low habitat scores do indicate that these streams (and their native fish populations) likely have little capacity to tolerate human caused environmental perturbations.

Ford Creek, Sun Drainage An environmental assessment (EA) was completed to transfer WCT from two Judith drainage streams (North Fork Running Wolf and East Fork Spring creeks) to North Fork Ford Creek. Disease samples taken from trout in 2002 were negative for all pathogens except for low–medium *Renibacterium salmoninarium* values. The transfer is planned for 2004, contingent on disease testing from East Fork Spring Creek and fish abundance in the donor populations.

Green Gulch, Teton Drainage Genetic samples collected in 2001 (20 PCR) and analyzed in 2003 confirmed that Green Gulch fish are pure WCT (Cook 2003) (Appendix 7). However, seven of the WCT analyzed exhibited an allele anomaly indicating potential regional polymorphism. To further test the genetic integrity of this population, additional WCT samples were collected from Green Gulch during 2003.

Genetic samples were collected from 25 WCT in the lower reaches (about one-quarter mile upstream from mouth: 47.85880, 112.75719) of Green Gulch on 17 July 2003. A reach approximately 2,400 ft. long was electrofished over 0.37 hrs. Twenty-seven WCT were sampled, averaging 7.3 inches total length (range: 1.5 - 8.7). CPUE was 11.2 WCT / 1000 ft, or 73.0 WCT / hr. shocking time. Mottled sculpins were abundant in this reach, and adult and larval Rocky Mountain tailed frogs were commonly observed.

Additional WCT samples were collected in upper Green Gulch on 15 August 2003 to provide a better longitudinal profile of this population than what was tested previously. A reach approximately 10,200 ft. was shocked in the upper two-thirds of the drainage, starting about 2.5 miles upstream of its mouth (47.82710, 112.75276). WCT were present in the first 460 ft. of the stream, but absent in the intermittent upper reaches above point: 47.82710, 112.75276. Ten genetic samples were collected from the WCT in this reach; shocking time was 0.11 hrs. Sampled WCT averaged 6.2 inches total length (range: 5.0 – 8.3). CPUE was 21.7 WCT / 1000 ft., or 90.9 WCT / hr. shocking

time for the short reach that contained fish. No other fish species or amphibians were observed in the upper reaches of Green Gulch.

Hall Creek, Two Medicine Drainage On July 21, 2003, ten genetic samples were collected from WCT fry in Hall Creek (Appendix 6 and 8). Water levels in Hall Creek were very low with some stranding of fish. Hall Creek is near a proposed exploratory drilling site.

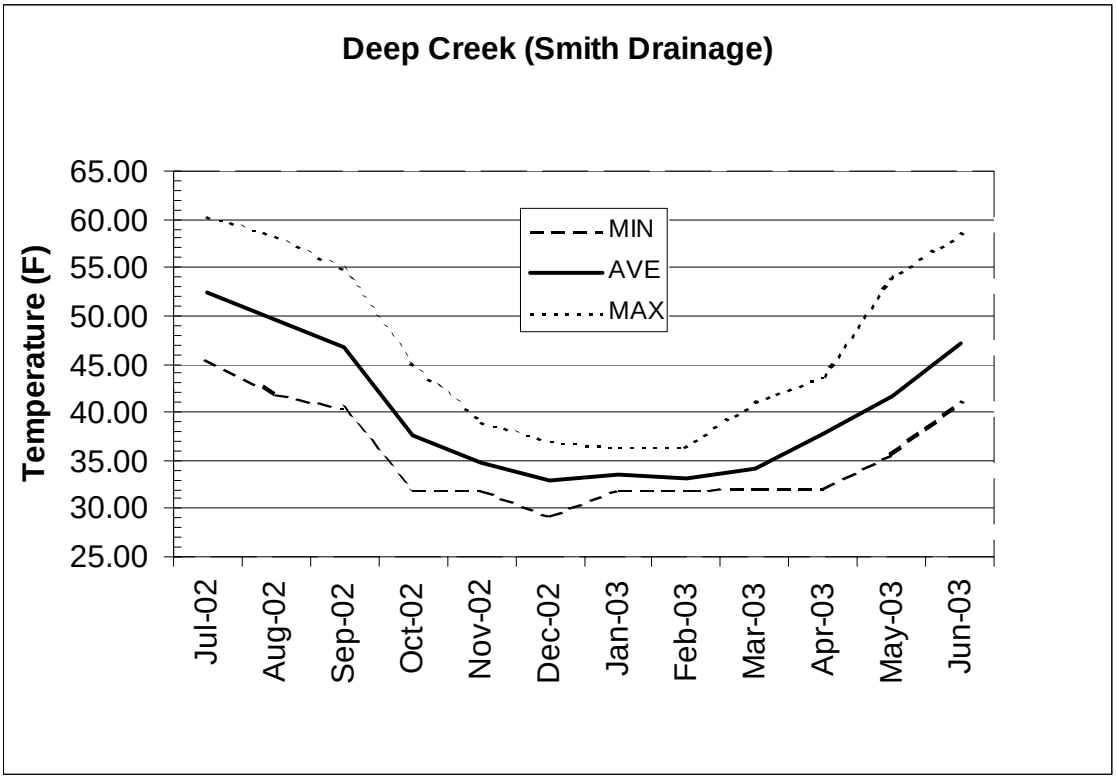
Midvale Creek, Two Medicine Drainage On September 9, 2003, a population estimate was obtained from the section of Midvale Creek immediately above a small reservoir west of East Glacier. Past genetic samples have shown that Midvale Creek fish are pure and would make good donors for replication in empty habitats with similar physical characteristics in the Two Medicine drainage. Density estimates were extremely low at 10 fish per 1000 ft. of stream (Table 3). Further population estimates will need to be obtained in 2004 to determine if the Midvale WCT population is robust enough to be used as a donor. Disease samples were collected on the same day population estimates were collected; fish were obtained downstream of the reservoir and were primarily rainbow and hybrids.

Petty Creek, Sun Drainage On July 8, 2003, 200 pure WCT from the North Fork of Deep Creek (Smith River drainage) were moved by helicopter to Petty Creek in the Sun drainage. This was the second year fish were transferred from the North Fork to Petty Creek. Cursory electrofishing surveys taken just before stocking revealed that the majority of fish transferred in 2002 had survived the winter. In addition, some fish appeared to have spawned. A thermograph that had been placed in 2002 was retrieved on the same day in 2003 (Figure 15). Figure 15 shows minimum, average, and maximum temperatures in North Fork of Deep Creek (Donor) and Petty Creek for 2002-2003. The disparity in temperatures between creeks and the extremely low temperatures in Petty Creek may make it difficult for newly emerged fry to reach adequate size before winter (B. Shepard *pers. comm.*) Moreover, low summer temperatures seem to play a limiting role in colonization based on models developed to assess adequacy of habitat for translocations (Young and Guenther-Gloss 2004; Harig and Fausch 2002). No more transfer will be completed but monitoring of the new population will be critical in determining the success of this transfer.

Sidney Creek, Two Medicine Drainage Genetic samples collected in 2001 (25 PCR) and analyzed in late 2002 confirmed that Sidney Creek fish are pure WCT (Cook and Knudsen 2002) (Appendix 7). The Sidney Creek WCT population is very small and only partially protected by a small barrier. This population is likely one of the last pure populations in the South Fork Two Medicine drainage.

Whiterock Creek, Two Medicine Drainage On October 1, 2003, 50 fish were transferred from Whiterock Creek to Lonesome Creek (Appendix 6). 50 fish were also transferred in 2002. One fish from the 2002 stocking was observed near the area fish were released in 2002. The success of these transfers will need to be determined before any further transfers occur in future years. A thermograph measured water temperature from 2002-2003 in Whiterock Creek (Figure 16). Summer water temperatures were

relatively high for a Front Range stream. In winter, the small pool that the thermograph was placed in froze for 5 months.



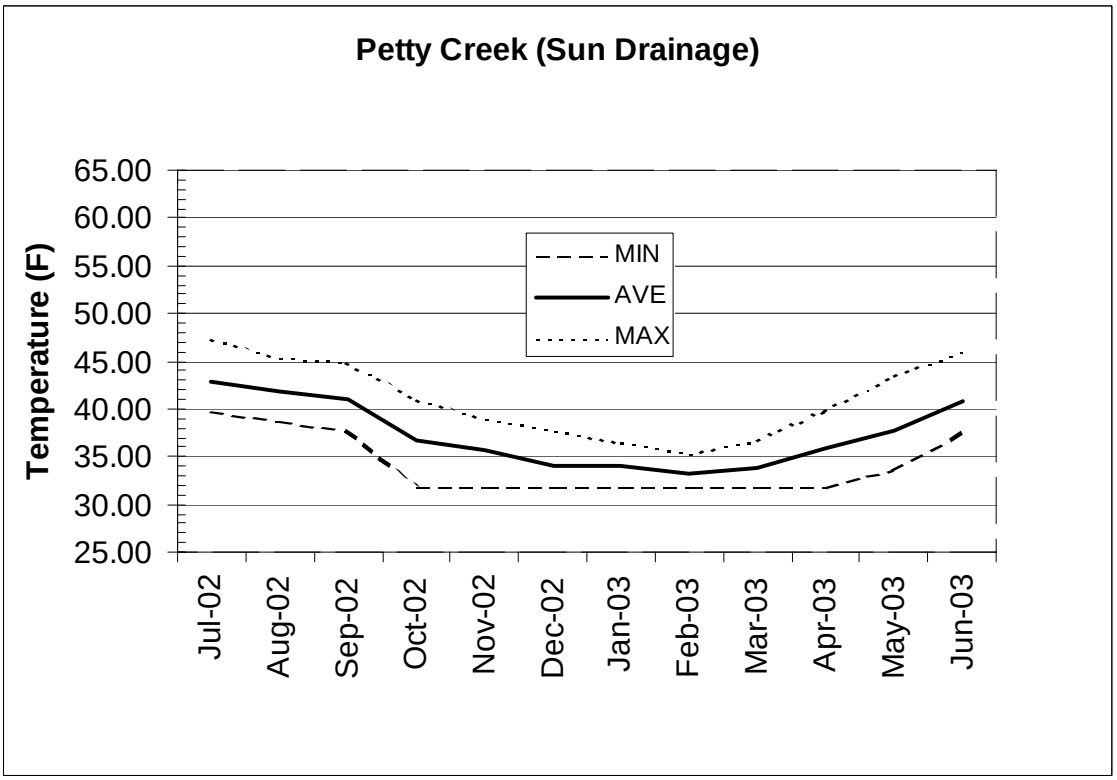


Figure 15. Stream temperatures in North Fork Deep Creek (Smith drainage; donor stream) and Petty Creek (Sun drainage; recipient stream), 2002-2003.

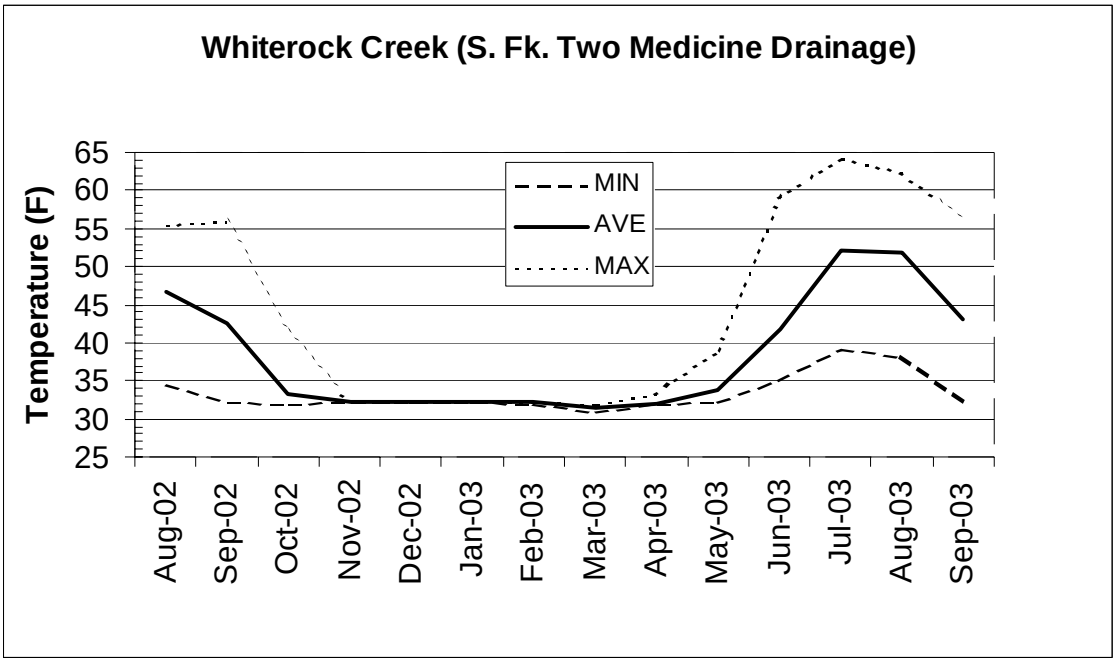


Figure 16. Water temperature in Whiterock Creek, Two Medicine drainage, 2002-2003.

Smith River

The major accomplishment related to WCT restoration in the Smith River involved transfer of 80 pure WCT from Cottonwood Creek (Castles) to 1.5 miles of empty habitat above a fish barrier on Middle Camas Creek (Big Belts) (Figure 17).

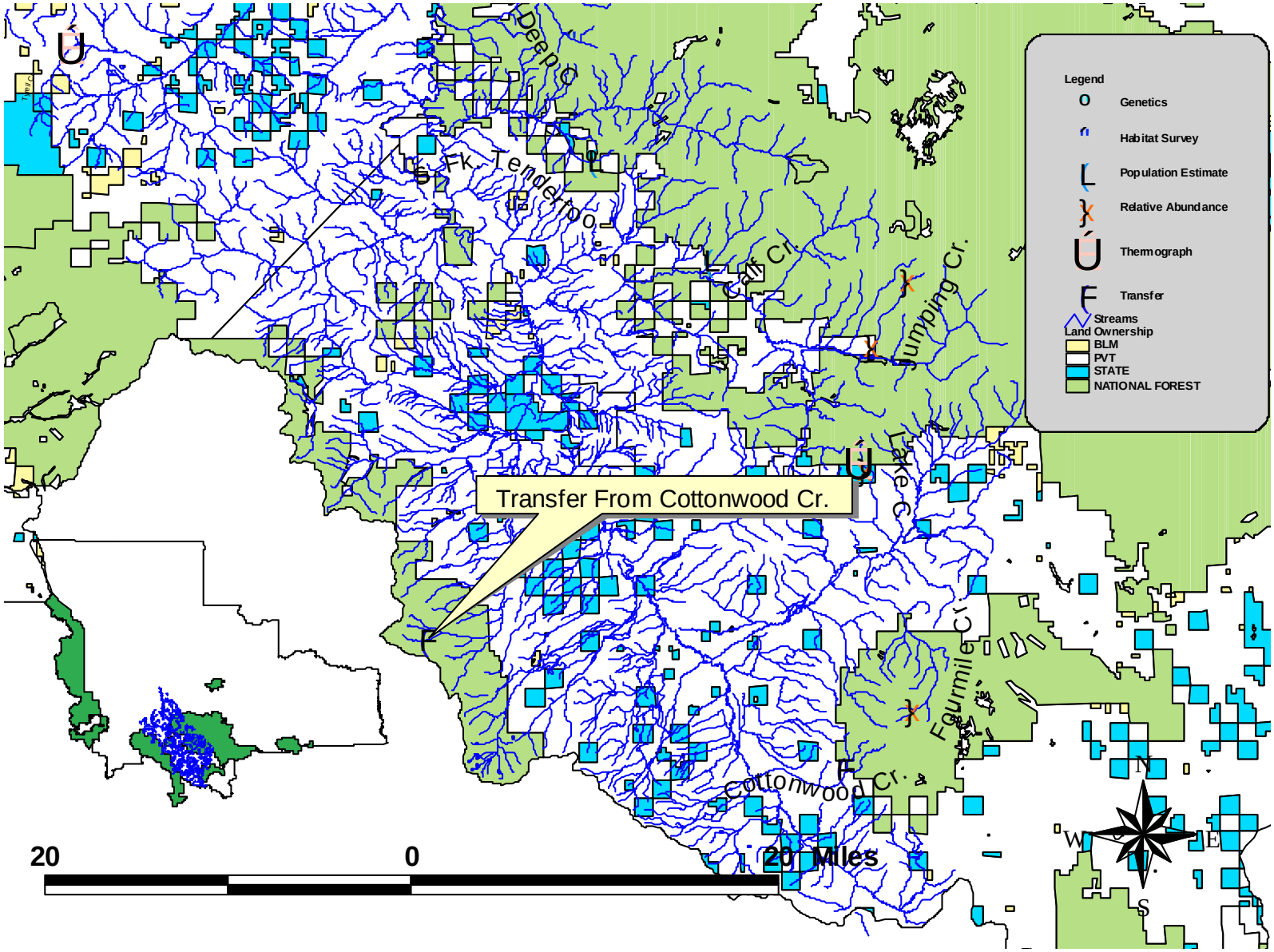


Figure 17. Work done in Smith drainage in 2003.

Balsinger Creek Genetic samples collected in 2001 (10 PCR) and analyzed in 2003 confirmed that Balsinger Creek fish are not pure (88% WCT x 10% YCT x 2% RBT)(Cook 2003)(Appendix 7). Balsinger Creek is a tributary to Twin Cabins Creek.

Black Butte Creek Genetic samples collected in 2000 (5 Allozyme) were analyzed in 2003 and revealed that the Black Butte Creek fish are heavily hybridized with rainbow trout (30% RBT) (Leary 2003)(Appendix 7). This creek runs through private property and is upstream of a barrier. Landowners recall past stocking by MFWP personnel. If landowners were to consent, this stream would be a good candidate for reintroduction of WCT.

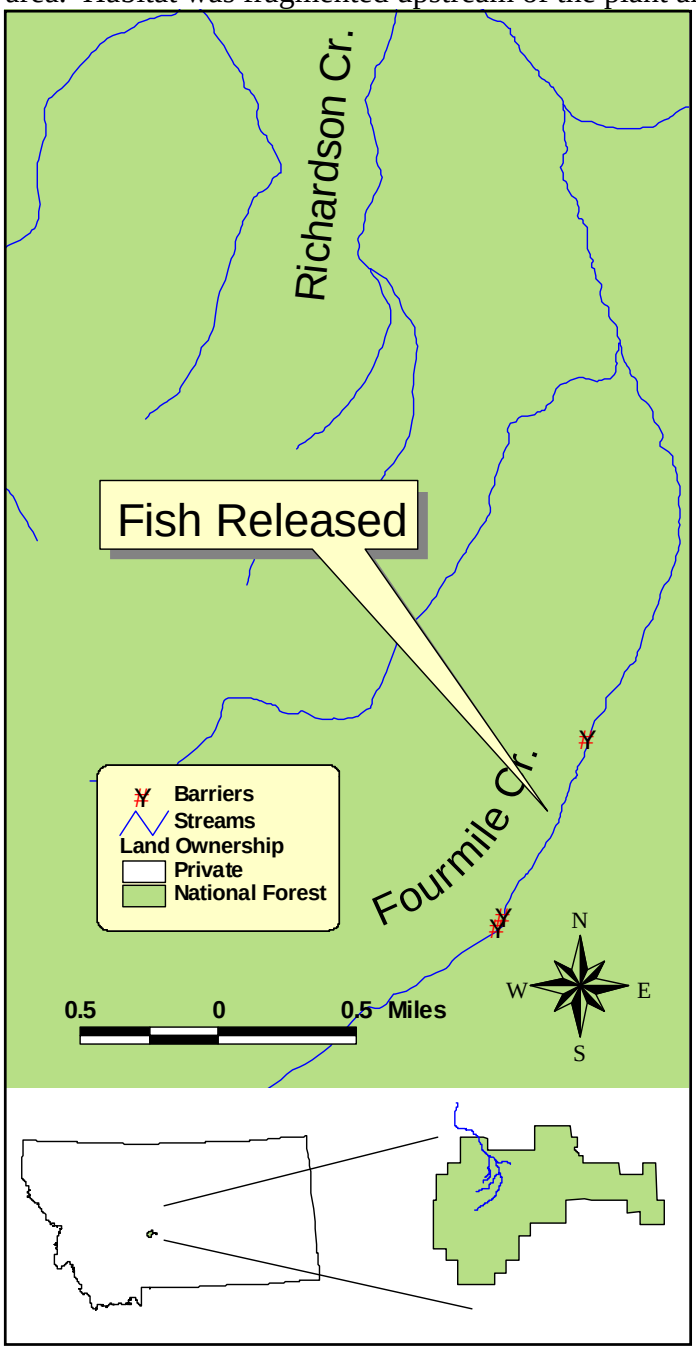
Middle Fork Camas Creek On July 29 2003, 80 fish were moved from the West Fork of Cottonwood Creek (Castle Mountains) to empty habitat above a fish barrier on Middle Fork Camas Creek, Helena National Forest. 25 of the fish moved were > 6" and 55 fish were ≤ 6" in total length (Appendix 6). Fish were moved in a well oxygenated live well in the bed of a pickup truck. At Middle Camas Creek, the fish were hiked approximately 0.75 mile above a permanent fish barrier (bedrock chute). Habitat in Middle Camas Creek is excellent with numerous pools formed by large woody debris. The stocked section is in a mature second growth forest with excellent riparian vegetation, clean spawning gravels, and ample over wintering pool habitat. An additional fish plant is planned for 2004. The source of fish will either be the West Fork of Cottonwood or other suitable stream identified though MEPA.

Calf Creek A population estimate was obtained from Calf Creek on October 6, 2003 (Table 3). The majority of fish sampled were rainbow trout with some brook trout. 8 of the fish had characteristics typical of westslope cutthroat trout (e.g. throat slashes)

Cottonwood Creek Genetic samples collected in 2000 (40 Allozyme) were analyzed in 2003 and confirmed that Cottonwood Creek fish are pure WCT (Leary 2003). Fish from a tributary of the Cottonwood Creek population are currently being used as donors for a new population in Middle Camas Creek.

Fourmile Creek In 2003, Fourmile Creek was intensively surveyed for habitat and fish (snorkeling and bank observations). In 2000, 50 fish from Richardson Creek were transferred to a fishless section upstream of large

waterfalls on Fourmile Creek. In 2003, Fourmile was surveyed from its headwaters down to the large waterfall barriers (Figure 15). One fish was found in the fish release area. Habitat was fragmented upstream of the plant area by two waterfall barriers (barriers are too large to remove) (Figure 18). This transfer was likely not successful. Future transfers in this stream should occur as high in the drainage as possible.



Judith Drainage

<u>North Fork Deep Creek</u>
Genetic samples collected in 2000 (5 Allozyme) from Deep Creek and analyzed in 2003 confirmed that North Fork Deep Creek fish are pure WCT (Leary 2003) (Appendix 7).

<u>Tenderfoot Creek</u> On August 21, 2003 a population estimate was obtained and genetic samples (20 PCR) were collected from WCT in the South Fork of Tenderfoot Creek (Appendix 6 and 8).

<u>West Fork Cottonwood Creek</u>
On 29 July 2003, 80 fish were transferred from the West Fork of Cottonwood Creek to Middle Camas Creek (See Middle Fork Camas Creek Description).

Figure 18. Fish transfer of fish from Richardson to Fourmile Creek, 2000.

Major accomplishments related to WCT restoration in the Judith drainage included planning and collection of biological information related to a proposed transfer of pure fish to approximately 1.5 miles of fishless habitat in upper West Fork Cottonwood Creek (Snowy Mountains); fish population estimates on the Dry Fork; habitat and fish surveys of Weatherwax and Harrison creeks; and surveys of East Fork Spring Creek prior to a planned transfer of pure WCT to North Fork Ford Creek (Rocky Mountain

Front) in 2004; and finally, completion of the Environmental Assessment for construction of a fish barrier on the SF Judith River near Bluff Mountain Creek (Figures 19 and 20).

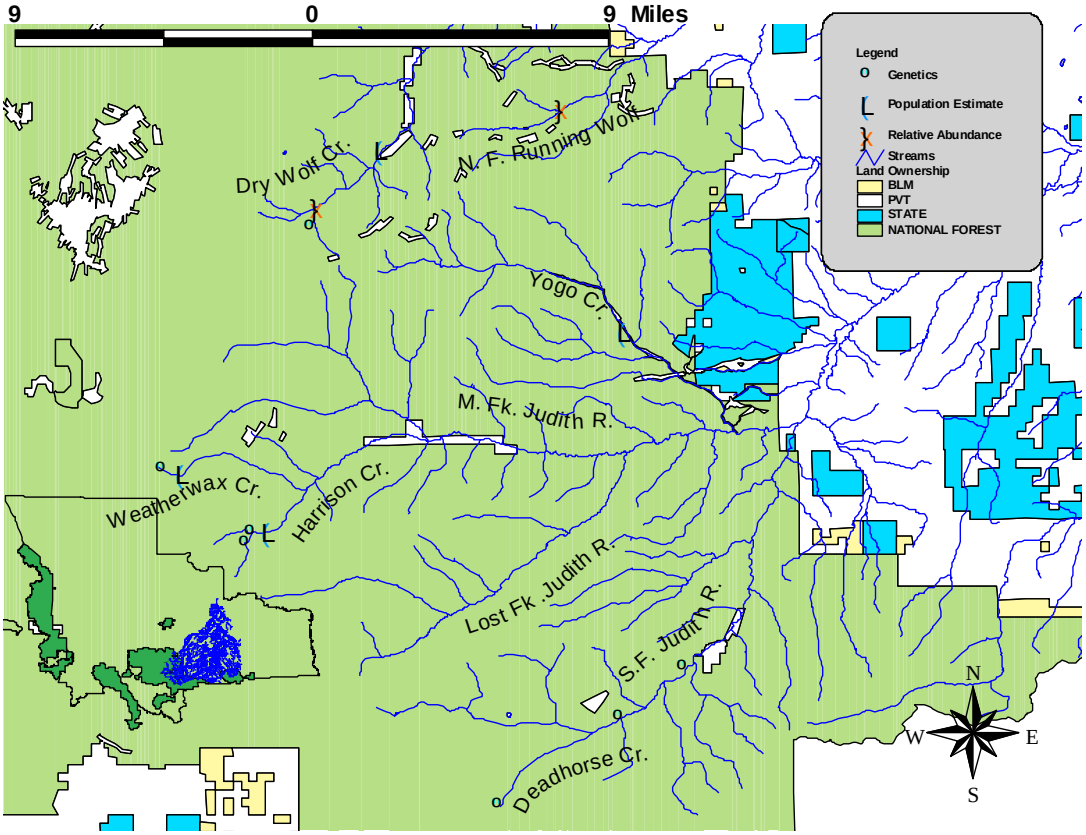


Figure 19. Work done in upper Judith River drainage in 2003.

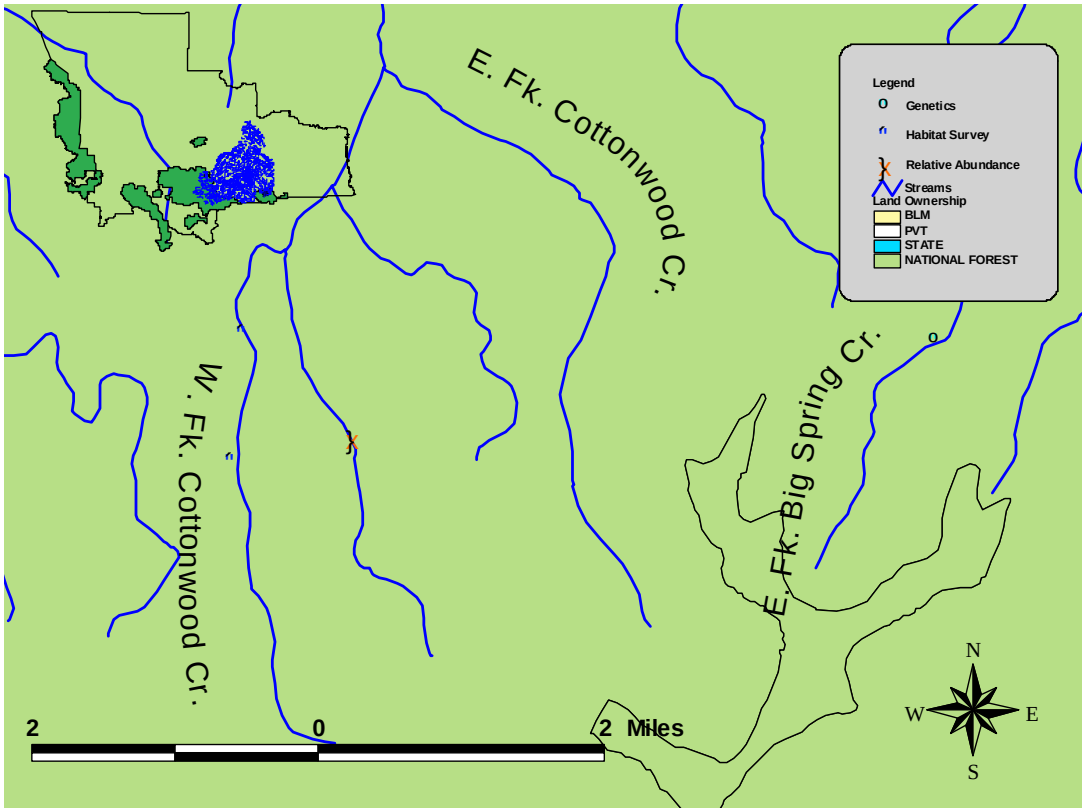


Figure 20. Work done in Snowy Mountains (Judith drainage) in 2003.

Big Hill Creek Genetics samples were taken from 35 fish to better define purity. Previous genetic testing from this stream found only 1 of 25 WCT with hybrid alleles. In 2003, sampling was conducted upstream of Forest Service road 487 (Appendix 6).

West Fork Cottonwood Creek Genetic samples collected in 2002 (25 PCR) and analyzed in 2003 revealed that West Fork Cottonwood creek fish are pure (Cook 2003). These fish were collected just downstream of a series of barriers which protect approximately 1.5 mile of protected headwater habitat (Figure 21). A tributary directly east of the protected headwater and upstream of the tested fish was surveyed for habitat September 4, 2003. High densities of fish (likely pure) were found in the eastern tributary. In addition, invertebrates and amphibians were sampled on October 15, 2003 above and below the fish barriers. Disease sampling may be waived because of the close

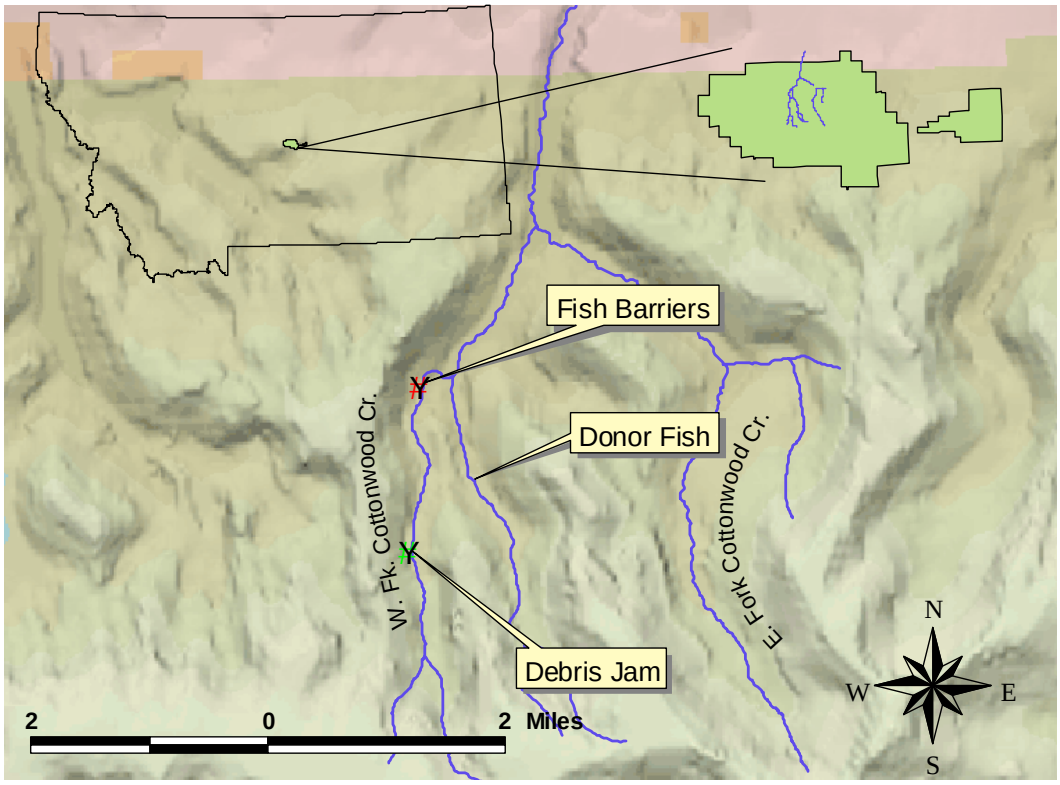


Figure 21. Proposed transfer of WCT from eastern tributary of W. Fk. Cottonwood to W. Fk. Cottonwood Cr., Lewis and Clark National Forest, Snowy Mountains.

proximity of donor and recipient reaches. An EA (MEPA) will be drafted in 2004 for a proposed transfer in 2004 (Figure 21).

Cross Creek The headwaters of this stream are fishless. On July 28, 2003 the fishless reach was surveyed to determine habitat quantity and quality. Maximum total pool depth averaged 20 inches. There was about 0.7 mile of habitat that could hold fish in late July. It appears this reach may have sufficient habitat to establish a small population of WCT. Further survey in late August/September is warranted to better determine habitat limitations.

Deadhorse Creek Tributary Genetic samples (PCR) were collected from 18 WCT in a tributary of Deadhorse Creek below Forest Service road 274 (Appendix 8).

Dry Wolf Creek Surveys were done on three sections and estimates completed on two sections of Dry Wolf Creek in 2003 (Table 3, Appendix 6). Figure 22 shows population trends above the campground in Dry Wolf Creek. Abundance of rainbow trout and brook trout appears to have increased after rainbow stocking was eliminated. In 2003, WCT numbers were at near record highs, in excess of 100 fish per 1000 feet and brook trout numbers were also above average. Mean total lengths were at record lows (Figure 22). Combined WCT and brook trout numbers exceeded trout estimates completed on

all other Judith basin streams in 2003 (Table 3) and 2002 (Moser et al. 2003). Both species were less abundant in the upstream section than above the campground (Table 3).

We are concerned about the potential impacts of brook trout on WCT and have briefly discussed management actions to prevent brook trout from replacing WCT in Dry Wolf Creek. Population trends over the last 8 years (Figure 22) indicate brook trout have not suppressed WCT and suggest it is not necessary to reduce brook numbers trout in Dry Wolf Creek. However, dynamics between these two species could change quickly; continued monitoring is essential. The WCT to brook trout ratio upstream from the standard electrofishing section is also encouraging. In 2003, we sampled trout 1.5 and 3.5 miles upstream of the long-term estimate section. The brook trout to WCT ratio was lower upstream (Table 3). Brook trout were not captured in the most upstream section (Table 3). Twenty-six cutthroat trout from the most upstream reach were taken for genetic survey, about 2 miles upstream from samples taken in 1994 (Appendix 6 and 8). The 1994 samples found WCT were slightly hybridized with Yellowstone cutthroat trout. Rhoda Lake, in the Dry Wolf Creek headwaters, usually has a dry outlet and was stocked with Yellowstone cutthroat trout for decades. The lake is now stocked with WCT and Arctic grayling. The outlet enters Dry Wolf Creek about 1 mile downstream of the recent genetic sampling site.

Much of lower Dry Wolf Creek (campground and upstream for about 1 mile) was "restored" with gabions and jetties after major flooding in 1964. Most of these structures are not functioning and this section of Dry Wolf Creek does not have a natural floodplain or meander pattern. As part of the Dry Wolf Stewardship Program, the Forest Service contracted for stream restoration work to remove the structures and create a more natural channel on a portion of the "restored" stream. This project has not yet been completed.

East Fork Big Spring Creek Fifty genetic samples collected in 1999 indicate WCT are pure in this stream (Leary 2000, Cook and Knudsen 2002). Disease and abundance surveys were completed on September 23, 2003 to determine if the WCT would be a suitable donor to establish a new population (Table 3). During the extended drought of 2003, there were about 1.5 – 2 miles of fish habitat. Visual surveys found WCT to the upper limit of water. Thirty WCT were sacrificed for disease testing (results pending). An estimate completed about 3 miles upstream of the National Forest boundary found about 104 WCT (>= 4 inches) per 1000 feet (Table 3). Extrapolation of this estimate for the entire stream suggests 700 – 1000 WCT >= 4 inches long live in East Fork Spring Creek. The population estimate was completed in some of the best habitat in the stream, so these numbers are likely inflated. However, many WCT less than 4 inches long were seen and there appear to be sufficient numbers to complete a fish transfer. We recommend a WCT transfer from East Fork to North Fork Ford Creek in 2004, contingent on results from disease tests. Major logistic planning will be necessary to move fish from East Fork Spring Creek.

Elk Creek Genetic samples collected in 2002 (5 PCR) and analyzed in 2003 revealed that Elk Creek fish are hybridized (98.2% x 1.8% RBT)(Appendix 7). The majority of the fish sampled in Elk Creek in 2002 were EB.

Harrison Creek The headwaters of Harrison Creek were sampled on August 6 and 7, where the two forks meet. Ten trout tested for genetics in 1996, about 2 miles downstream, displayed only WCT alleles with the exception of one rainbow allele in one fish (Kanda and Leary 1998), so further genetic sampling is needed to better define purity of the upper Harrison WCT. Twenty-five genetics samples were taken from each fork and a population estimate was completed immediately downstream of their confluence (Table 3). There were about 69 WCT per 1000 feet and WCT up to 8.7 inches were captured (Appendix 6). One brook trout was sampled below the forks and sculpin were common in the estimate section and the western tributary. The southern tributary had a large log drop near the mouth and did not contain mottled sculpin. The stream habitat was small but some residual pool depths exceeded 1 foot above the forks.

Judith River, South Fork Twenty-five *Oncorhynchus* sp. were taken for allozyme genetics analysis from two sections on the South Fork Judith. *Oncorhynchus* sp. in both sections visually appear to be hybrid swarms of rainbow trout and WCT. One set of samples was taken upstream of Cross Creek and the other upstream of Bluff Mountain Creek. Understanding the genetics of these populations is important due to the electrofishing removals that will be considered once a barrier is built below Bluff Mountain Creek. Partial funding for a barrier was obtained from the MFWP Future Fisheries Program ($49,313). Funding from the Future Fisheries Program was solely for physical construction of the barrier; additional cost associated with NEPA etc. will be obtained elsewhere. Additional funding was obtained from the Montana Trout Foundation ($1,500) and the Montana Chapter of the American Fisheries Society ($1,500). A scoping letter describing the project was sent on March 31, 2003. A final EA was mailed on January 16, 2003 (USFS 2004). If no negative comments are received, design and engineering can commence after the decision notice is completed. Construction will either commence late fall of 2004 or summer of 2005.

Temperature data obtained from temperature loggers placed in the South Fork Judith downstream of Big Hill Creek, Bluff Mountain Creek and Dry Pole Creek is displayed in Figure 23. As in past years, (Moser et. al 2003) temperatures increased going downstream (Figure 24). Maximum water temperatures downstream of Dry Pole occasionally exceeded 75˚ F, which is 10˚ F less than the 84˚ F critical thermal maximum for wild trout (Carline and Machung 2001). Mean summer water temperature was often near 65˚ F. Temperatures for all of these reaches were slightly higher than seen in 2002 (Moser et. al 2003).

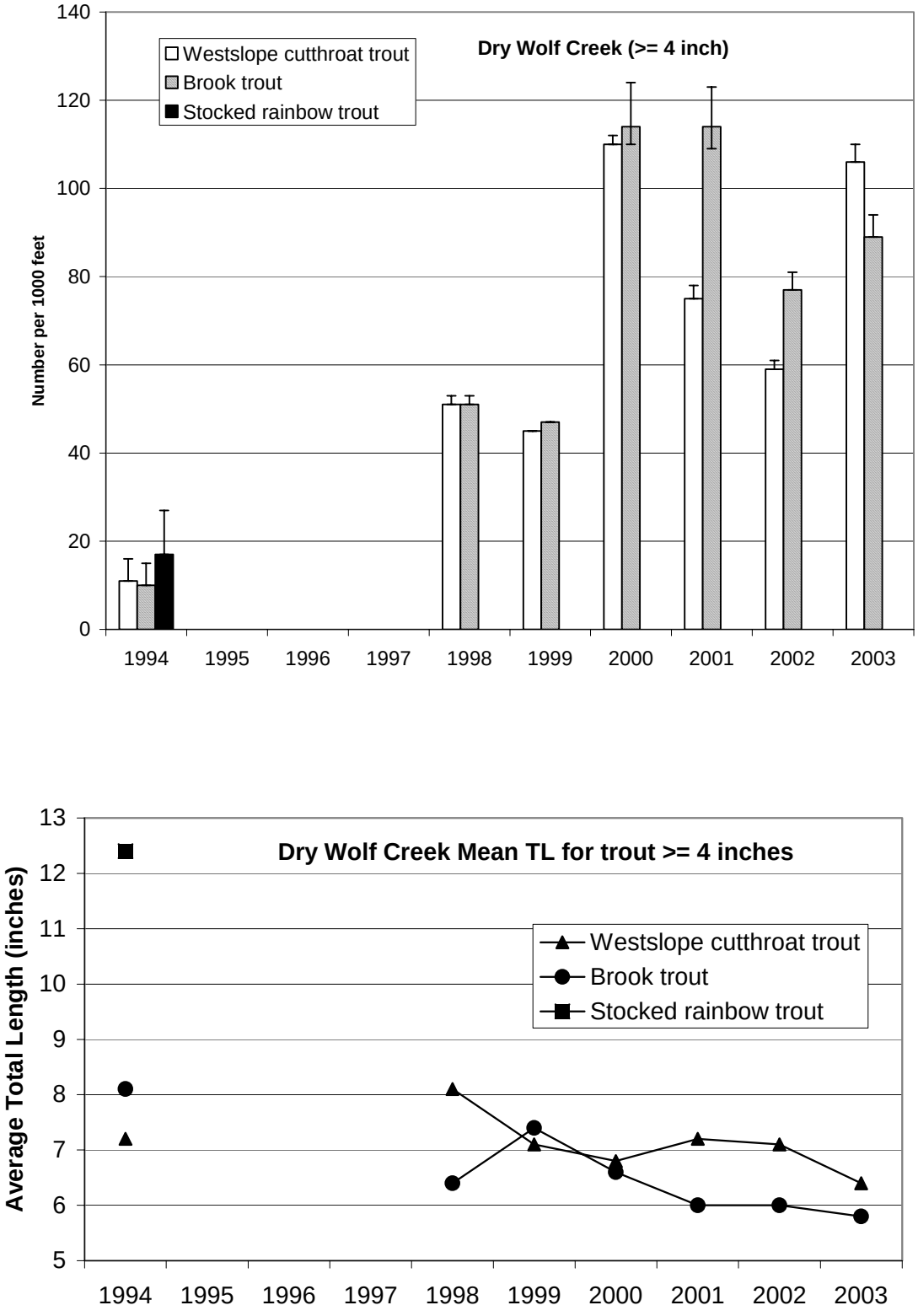


Figure 22. Population trends (upper graph) and total length trends over several years in Dry Wolf Creek (Judith) in a 492-foot section (660 feet in 1994) located about 1 mile upstream of the USFS campground (T14N R9E S13).

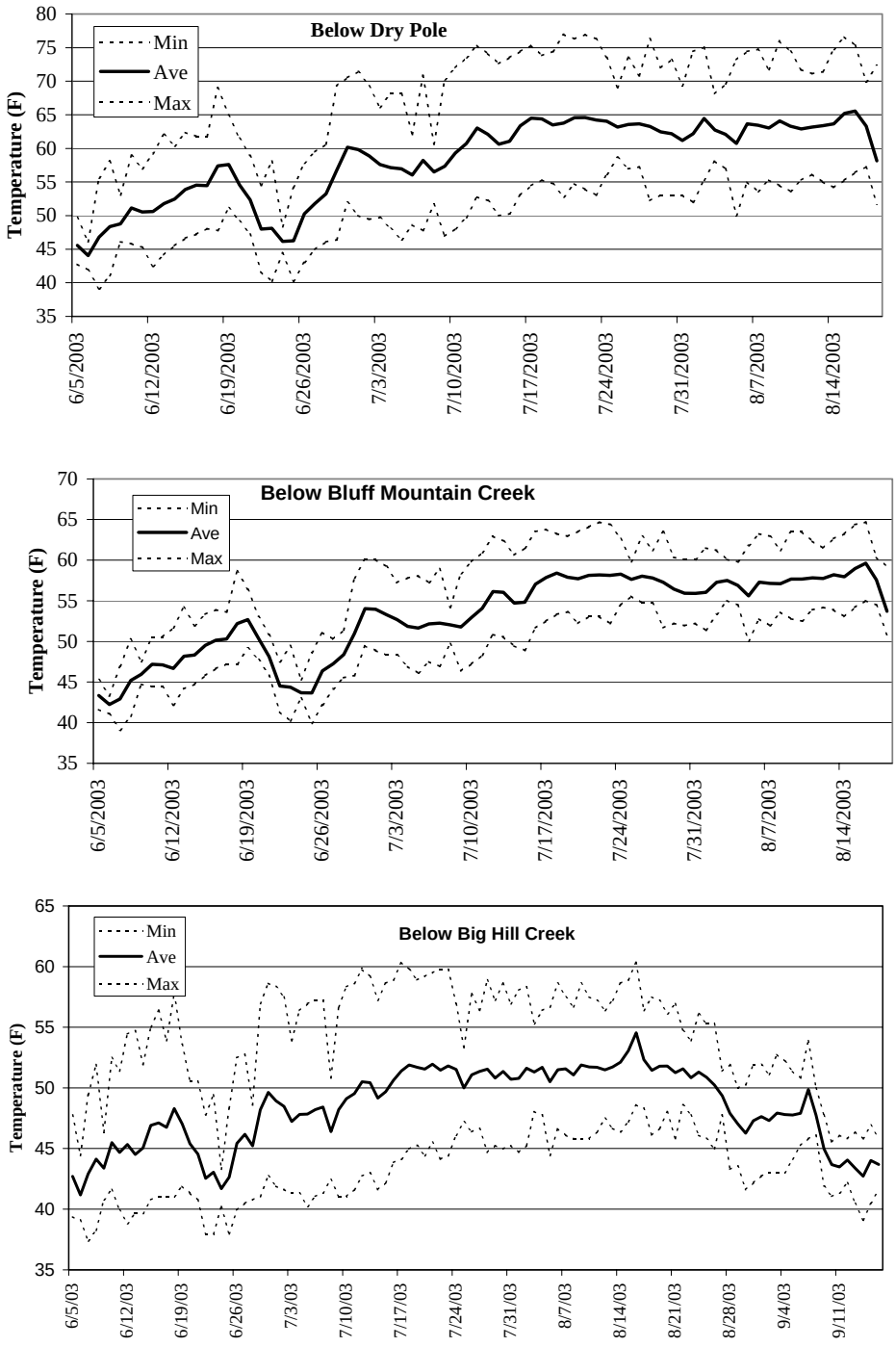


Figure 23. Temperatures from three sections of the South Fork Judith River, 2003.

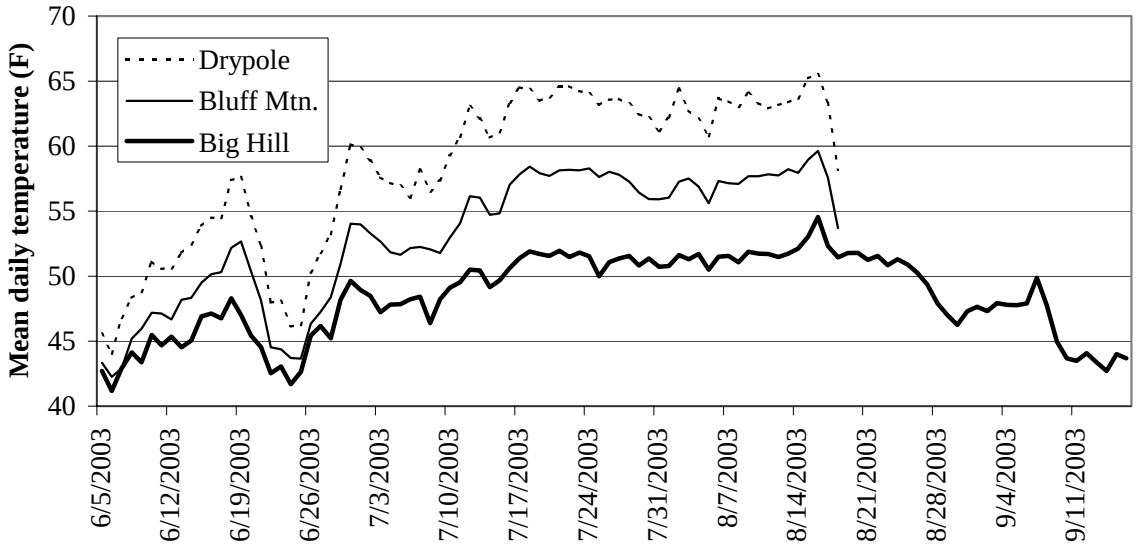


Figure 24. Temperature gradient on the South Fork Judith River in 2003.

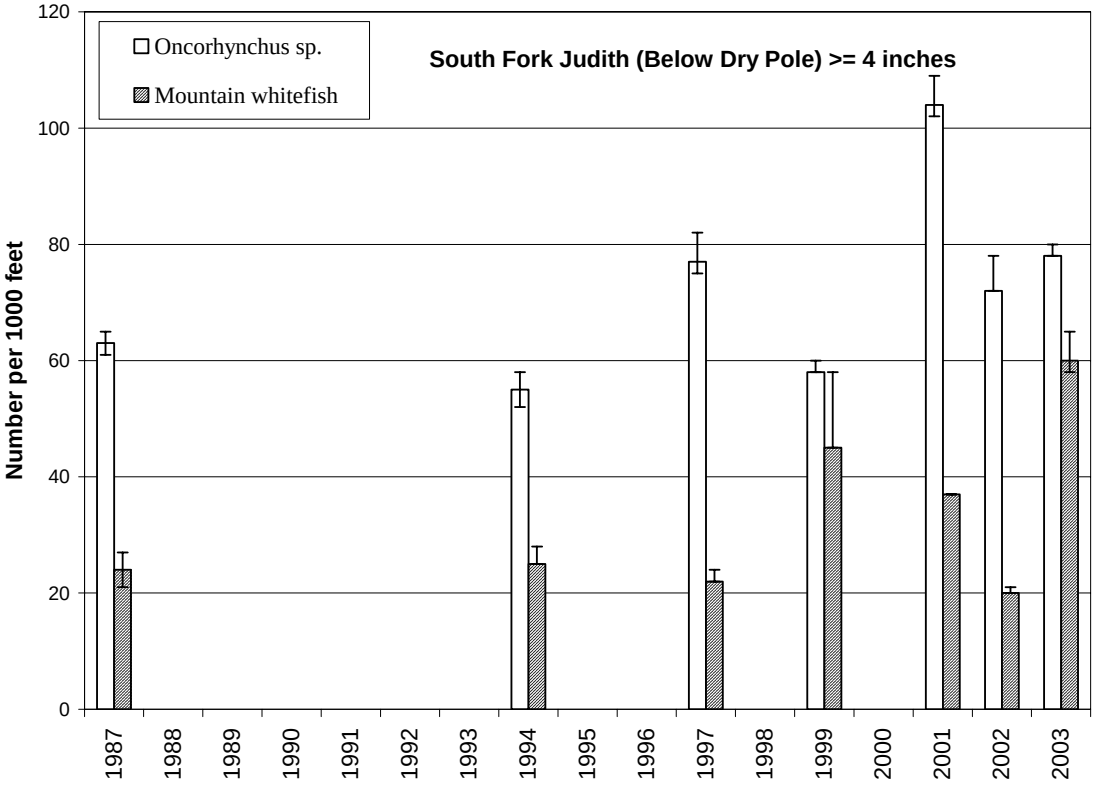


Figure 25. Population estimates on the South Fork Judith River below Dry Pole Creek for fish >= 4 inches total length.

A population estimate was completed below Dry Pole Creek. Mountain whitefish numbers were at record high levels and *Oncorhynchus* sp. numbers were slightly above average (Figure 25). The majority of trout in this reach are rainbow trout. One brook trout was captured in 2003 (Table 3).

Running Wolf Creek, North Fork Fifteen fish samples amplified by PCR tested negative for whirling disease at the Fish and Wildlife Service, Fish Health Lab in Bozeman. Electrofishing surveys found about 50% less WCT in a section of this stream than found in 2002 (Moser et. al 2002). Population numbers are so low, it seems likely there are insufficient fish to maintain this population and move adults to another stream. As an alternative, we will consider transferring young of the year fish in early fall. Genetic samples collected in 2001 (25 PCR) and analyzed in 2003 confirmed that North Fork Running Wolf Creek fish are pure (Appendix 7).

Russian Creek Tributary Genetic samples collected in 2002 (25 PCR) and analyzed in 2003 revealed the Russian Creek Tributary fishes are slightly hybridized (97.5% WCT x 2.3% RBT)(Appendix 7).

Weatherwax Creek The headwaters of this stream were sampled to determine the upper limit of trout habitat and to obtain genetics samples from the most upstream fish. However, a visual stream survey completed in August, suggests marginal fish habitat likely continues 1 – 2 miles upstream of the sampling site. Twenty-five fish were sampled for genetics and will be tested in 2004 (Appendix 6 and 8). It is unlikely these fish are pure WCT. Ten samples of *Oncorhynchus* sp. taken 1.5 miles downstream in 1996, were 91% WCT and 9% rainbow trout (Kanda and Leary 1998). Furthermore, one brook trout was sampled in 2003, indicating it is highly unlikely a barrier protects these fish from introgression with downstream rainbow trout. The trout estimate for Weatherwax Creek was about half of that seen in Harrison and was far less than any other estimate from Judith streams sampled in 2003 (Table 3; Appendix 6)). Residual pool depths in the estimate reach were up to 1.7 feet.

Yogo Creek A survey on July 30, 2003 found a partial barrier about halfway between Boulder Creek and Lead Gulch. Yogo Creek was barren above the lower barrier but there appears to be a bypass channel during very high flow. No fish were captured during about 30 minutes (1000 seconds on-time) of electrofishing above the barrier. Two other barriers are also located on this reach. An additional beaver dam barrier is at the upper limit of fish habitat. There is about 1 mile total habitat. The habitat in upper Yogo Creek looks far superior to what is in North Fork Running Wolf. We collected 13 WCT from immediately below the barrier. The fish community was primarily brook trout with a few WCT. Mottled sculpin were not sampled in the vicinity of Boulder Gulch. The upper mile of Yogo Creek should be considered for a WCT transfer. During a site visit in early October there appeared to be adequate water to establish a small population. The population would have far less than the 2000 fish recommended by Hilderbrand and Kershner (2000), but many more fish than found in several native populations.

Lower Yogo Creek was sampled near Sawmill Gulch (Table 3). This section was last sampled in 1987 (MFWP 1989). Trout populations were similar both years with 140 – 150 trout >= 4 inches. During both years about 90% of the trout were brook trout. Brook trout are the most common fish into the headwaters, where WCT exceed 90% purity in both upper Yogo and Elk Creek. *Oncorhynchus* sp. are primarily rainbow trout in the lower reaches.

Musselshell Drainage

Halfmoon Creek Genetic samples collected in 2002 (25 PCR) and analyzed in 2003 confirmed that Halfmoon creek fish are pure WCT (Cook 2003).

Table 3. Depletion removal population estimates for fish >= 4 inches from small northcentral Montana streams in 2003.

Stream Legal Section length Drainage	Date	Species	#/1000 ft (95% CI)	Average total length (inches)	Probability of capture
Calf Cr. T13N R6E S34SW Below road crossing (150 feet) (Smith drainage)	10/06/2003	*Oncorhynchus* sp.	126 (126-148)	5.1	0.68
		Brook trout	7 (--)	4.8	No fish caught seco pass
Chamberlain Cr. T13N R8E S2SE Lower (100 feet) (Belt drainage)	8/20/2003	Westslope cutthroat trout	58 (58-64)	6.4	0.86
		Brook trout	18 (--)	6.1	No fish caught seco pass
Chamberlain Cr. T13N R8E S2SE Upper (150 feet) (Belt drainage)	8/20/2003	Westslope cutthroat trout	83 (83-85)	6.3	0.95
Dry Wolf Cr. T14N R9E S13 Above camp (492 feet) (Judith drainage)	9/25/2003	Westslope cutthroat trout	106 (106 – 110)	6.4	0.91
		Brook trout	89 (89 – 94)	5.8	0.88
Dry Wolf Cr. T14N R9E S23 Above Snow Creek (394 feet) (Judith drainage)	9/25/2003	Westslope cutthroat tr	56 (51 – 71)	5.4	3 pass
		Brook trout	8 (8 – 10)	4.8	3 pass

Stream Legal Section length Drainage	Date	Species	#/1000 ft (95% CI)	Average total length (inches)	Probability of capture
East Fork Big Spring Creek T12N R19E S4 (440 feet) (Judith drainage)	9/23/2003	Westslope cutthroat trout	104 (102 – 111)	6.1	0.83
Harrison Creek T12N R9E S17NE (508 feet) (Judith drainage)	8/6/2003	Westslope cutthroat trout	69 (67 – 77)	5.8	3 pass
South Fork Judith T12N R11E S23 Below Dry Pole (653 feet) (Judith drainage)	9/3/2003	Mountain whitefish	60 (58 – 65)	6.0	0.81
		Rainbow trout	78 (78 – 80)	7.2	0.94
Midvale Cr. T 31N R13W S14 Above reservoir (150 Feet) (Two Medicine drainage)	9/9/2003	Westslope cutthroat trout	10 (10-13)	5.7	0.83
Tenderfoot Cr. T13N R5E S4 (100 feet) (Smith drainage)	8/21/2003	Westslope cutthroat trout	34 (34-40)	6.7	0.93
Weatherwax Creek T12N R9E S5E (540 feet) (Judith drainage)	8/5/2003	Westslope cutthroat trout	35 (35 – 39)	6.2	3 pass
Yogo Creek T13N R11E S18SE Above Sawmill (584 feet) (Judith drainage)	8/19/2003	Brook trout	122 (118 – 130)	5.5	3 pass
		Oncorhynchus sp.	15 (15 – 15)	6.7	3 pass

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Code numbers of waters referred to in report

17	200	Balsinger Cr.
16	220	Big Coulee Cr.
16	260	Big Hill Creek
17	1108	Black Butte Cr.
17	1168	Calf Cr.
17	1184	Camas Cr.
17	1248	Carpenter Cr.
17	1424	Chamberlain Cr.
17	1728	Cottonwood Cr. (Upper Missouri)
17	1729	Cottonwood Cr. (Castles)
16	760	Cottonwood Cr. (Highwoods)
16	1400	Cottonwood Cr., E. Fk. (Snowies)
16	4050	Cottonwood Cr., W. Fk. (Snowies)
14	1000	Cow Cr.
17	1840	Crawford Cr.
16	980	Cross Cr.
16	1100	Deadhorse Cr.
17	5280	Deep Cr., N. Fk.
16	1280	Dry Wolf Cr.
14	1640	Dupuyer Cr.
14	3840	Dupuyer Cr., N. Fk.
14	3480	Dupuyer Cr., Middle Fk.
14	5480	Dupuyer Cr., S. Fk.
16	1340	E. Fk. Spring Cr.
16	1460	Elk Cr.
17	2624	Elkhorn Cr.
21	2150	Ford Cr.
17	2816	Fourmile Cr.
17	3152	Graveyard Gulch
14	2240	Green Gulch
18	2940	Halfmoon Cr.
14	2280	Hall Cr.
17	3344	Harley Cr.
16	1660	Harrison Cr.
17	9140	Hound Cr. Reservoir
17	3814	James Cr.
17	4096	Little Belt Cr.
17	4304	Logging Cr.
17	4374	Lost Cr.
17	4645	Middle Fk. Camas Cr.
14	3560	Midvale Cr.
17	5888	Pilgrim Cr.
16	2702	Running Wolf Cr., N. Fk.
16	3180	Russian Cr.
17	6656	Shonkin Cr.
14	5080	Sidney Cr.
17	6752	Skelly Gulch
16	3520	South Fk. Judith
17	7536	Tenderfoot Cr.
17	7958	Tyrell Cr.
16	3940	Weatherwax Cr.
14	6600	Whiterock Cr.
16	4260	Yogo Cr.

Appendix 1. Decrease since the 2000 SRS in miles of stream with genetically pure WCT based on new genetic information. Many sample sizes consist of at least 25 fish (95 % chance of detecting 1% of introgression).

Drainage	Stream	Miles 2000	% WCT 2000	% WCT Current	Last Surveyed
Belt					
	Harley Cr., Lower	1.00	100.00%	50.00%	1999
	James Cr.	2.00	100.00%	95.67%	2001
	Lost Cr.	1.00	100.00%	94.50%	2002
	Lost Cr.	1.00	100.00%	94.50%	2002
	Oti Park Cr.	5.00	100.00%	96.80%	2001
	Sawmill Cr.	3.00	100.00%	98.30%	2001
	Spruce Cr.	0.50	100.00%	99.20%	1999
		13.50			
Highwood					
	Highwood Cr., N. Fk.	1.00	100.00%	82.00%	1999
		1.00			
Judith					
	Big Hill Cr.	2.00	100.00%	99.70%	2000
	Bluff Mtn. Cr.	5.00	100.00%	92.00%	2000
	Cross Cr.	1.00	100.00%	96.60%	2000
	Deadhorse Cr.	4.00	100.00%	94.00%	2000
	Elk Cr.	1.00	100.00%	98.20%	2002
	Placer Cr.	3.00	100.00%	90.00%	1999
	Russian Cr., Upper	0.50	100.00%	97.50%	2002
		16.50			
Smith					
	Daniels Cr.	3.00	100.00%	99.60%	2001
		3.00			
Teton					
	Teton River, E. Fk.	1.50	100.00%	96.40%	2001
	Waldron Cr., N. Fk.	1.50	100.00%	99.00%	2000
		3.00			
Two Medicine					
	Lee Cr.	2.00	100.00%	97.70%	2002
	Whiterock Cr.,	3.00	100.00%	99.60%	2001
	Woods Cr., E. Fk	2.00	100.00%	98.00%	2001
		7.00			
Upper Missouri					
	Elkhorn Cr., N. Fk. and S.	8.00	100.00%	87.60%	2002
		8.00			
Total		**52.00**			

Appendix 2. Increase in miles of stream with genetically pure WCT since the 2000 SRS report. With the exception of Jumping Cr. (7) sample sizes are ≥ 25 (95% chance of detecting 1% of introgression). Note: *Lonesome Cr. 99.60% pure was included in this table.

Drainage	Stream	Code	Miles	Genetic
Belt				
	Bender Cr.	New Stream Site	0.50	100.00%
	Crawford Cr.	New Upstream Information	1.00	100.00%
	Gold Run Cr., Upper, Upper	Upstream Expansion	0.25	100.00%
			1.75	
Judith				
	Cottonwood Cr., W. Fk.	New Upstream Information	1.00	100.00%
	Spring Cr., E. Fk.	New Stream Site	2.50	100.00%
			3.50	
Smith				
	Jumping Cr.	New Stream Site	2.00	100.00%
	Mid Camas Cr.	Replicated Population	1.50	100.00%
			3.50	
Sun				
	Petty Cr.	Replicated Population	3.00	100.00%
			3.00	
Two Medicine				
	Lonesome Cr.	Replicated Population	2.00	99.60%
	Midvale Cr.	New Stream Site	4.00	100.00%
	Sidney Cr. Above Barrier	New Upstream Information	1.00	100.00%
			7.00	
Total			**18.75**	

Appendix 3. Stream miles confirmed to be genetically pure WCT because of additional or new genetic information.

Drainage	Stream	Miles	Collect Date	Recent Date
Arrow				
	Cottonwood Cr.	2.00	1995	2001
		2.00		
Belt				
	Carpenter Cr.	3.00	1997	2000
	Chamberlain Cr.	5.00	1998	1999
	Gold Run Cr., Upper	0.25	Pending	2001
	Graveyard Gulch	1.50	1995	1999
	Harley Cr., Upper	1.00	1996	1999
	Harley Cr., Upper, Trib.	1.00	Pending	1999
	Little Belt Cr., M. Fk.	1.00	Assumed	2001
	Little Belt Cr., M. Fk., Upper	1.00	1997	2001
		13.75		
Highwood				
	Big Coulee Cr.	2.00	1998	2002
		2.00		
Musselshell				
	Half Moon	5.00	1994	2002
		5.00		
Smith				
	Cottonwood Cr., E. Fk & W. Fk.	4.50	1992	2000
	Deep Cr., N. Fk	2.00	1985	2000
	Deep Cr., N. Fk, Upper	2.00	2000	2000
		8.50		
Teton				
	Green Gulch, Upper	2.00	1993	2000
	Willow Cr., N. Fk.	1.50	1990	2001
		3.50		
Upper Missouri				
	Skelly Gulch	3.50	1991	2002
	Three Mile Cr.	5.00	1996	1999
		8.50		
Total		**43.25**		

Appendix 4. Change in miles of stream with pure and nearly pure WCT since the 2000 SRS because of new information from upstream sites, adjustments in map distance, distance changes because of new upstream genetic data, possible extinction, and unsuccessful transfer.

Drainage	Stream	Miles	Purity	Date	Miles	Purity	Date	Activity
Belt								
	Crawford Cr.				1.00	100.00%	2001	New Upstream Information
	Crawford Cr., Lower	2.00	67.00%	1997	1.00	67.00%	1997	Distance Change Because of New Upstream Data
Judith								
	Cottonwood Cr., W. Fk.				1.00	100.00%	2002	New Upstream Information
	Cottonwood Cr., W. Fk. & E. Fk.	5.00	98.00%	1996	8.00	98.00%	1996	Distance Change Because of New Upstream Data
	Judith River, S. Fk., Upper	11.00	98.00%	1997	11.00	97.50%	2000	Decrease From Less Than Pure Because of New Data
	Russian Cr., Trib				0.50	97.50%	2002	New Upstream Information
Smith								
	Big Camas Cr.	3.30	96.00%	1991	1.30	96.00%	1991	Distance Change Because of New Upstream Data
	Big Camas Cr., Upper				2.00	0.00%	2001	New Upstream Information
	Black Butte Cr.	8.00	75.00%	1996	8.00	70.00%	2000	Decrease From Less Than Pure Because of New Data
	Deep Cr., S. Fk.	2.00	97.00%	1988	2.00	95.50%	2000	Decrease From Less Than Pure Because of New Data
	Fourmile Cr., Upper	4.00	100.00%	Transfer	1.00	100.00%	2000	Transfer Not Successful
Teton								
	Cow Cr.	1.50	100.00%	1990	1.50	99.50%	2000	Not Found in 2003, Possibly Extinct
Two Medicine								
	Dupuyer Cr., M. Fk., Above dam	2.00	100.00%	1997	0.62	100.00%	1997	Cartography Change
	Dupuyer Cr., N. Fk.	8.00	95.00%	1990	3.40	95.00%	1990	Cartography Change
	Dupuyer Cr., S. Fk., Upper	3.00	100.00%	Transfer	1.40	100.00%	Assumed	Cartography Change
	Rival Cr.	1.00	100.00%	Transfer	0.50	100.00%	Assumed	Cartography Change
	Sidney Cr.	2.00	98.00%	1992	1.00	98.00%	1992	Distance Change Because of New Upstream Data
	Sidney Cr. Above Barrier				1.00	100.00%	2001	New Upstream Information

Appendix 5. Genetically pure streams in 2000 that have had no new genetic information.

Drainage	Stream	Miles Stream	Genetic Purity
Arrow			
	Boyd Cr.	1.00	100.00%
		1.00	
Belt			
	Belt Cr., Upper	6.00	100.00%
	Gold Run Cr.	3.00	100.00%
	Horn Cr.	2.00	100.00%
	Little Belt Cr., N. Fk., Lower	1.00	100.00%
	Little Belt Cr., N. Fk., Upper	1.50	100.00%
	Logging Cr.	2.00	100.00%
	O'Brien Cr.	2.25	100.00%
	Pilgrim Cr., Upper	5.00	100.00%
	Shorty Cr.	1.00	100.00%
	Tillinghast Cr.,	5.00	100.00%
		28.75	
Judith			
	Harrison Cr., Upper	3.00	100.00%
	Running Wolf Cr., N. Fk	2.00	100.00%
	Snow Cr.	0.50	100.00%
		5.50	
Musselshell			
	Collar Gulch	2.00	100.00%
		2.00	
Smith			
	Deadman Cr. N. Fk.	1.50	100.00%
	French Cr., Lower/Upper	1.50	100.00%
	Richardson Cr.	1.50	100.00%
		4.50	
Teton			
	Rierdon Gulch, Upper	2.00	100.00%
		2.00	
Two Medicine			
	Badger Cabin Cr.	2.00	100.00%
	Birch Cr., S. Fk.	4.00	100.00%
	North Badger Cr.	20.00	100.00%
	Red Poacher Cr.	2.00	100.00%
	South Badger Cr.	1.00	100.00%
		29.00	
Upper Missouri			
	Rooster Bill	2.00	100.00%
		2.00	
Upper Missouri			
	Page Gulch	1.50	100.00%
		1.50	
Total		**76.25**	

Appendix 6. Statistics of fish captured during stream surveys in 2003. Samples were collected by MFWP and the USFS.

Stream, Survey Type Legal Date (Drainage)	Length (feet)	Hours Sampled	Species	N	Total Length (inches) Min	Max	Avg	CPUE (1000 feet)	CPUE (hour)
Big Coulee, Mark - Movement	262	0.00	EB	7	4.0	8.0	5.8	27	--
T 20 N R 9E Sec 10									
5/22/03 (Highwood)									
Big Coulee, Suppression	--	1.52	WCT	2	3.5	7.6	4.9	--	1
T 19N R 9E Sec 10	--	1.52	EB	38	5.2	5.2	5.2	--	25
6/10/03 (Highwood)									
Big Coulee, Suppression	--	0.67	WCT	8	4.4	5.9	5.0	--	12
T 19N R 9E Sec 10	--	0.67	EB	9	4.6	7.3	6.5	--	14
6/19/03 (Highwood)									
Big Coulee, Suppression	623	0.80	WCT	1	5.5	5.5	5.5	2	1
T 20N R 9E Sec 10NW	623	0.80	EB	39	5.9	8.9	6.8	63	49
6/30/03 (Highwood)									
Big Coulee, Suppression	1247	2.50	WCT	3	5.7	7.4	6.7	2	1
T 20 N R 9E Sec 10NW	1247	2.50	EB	23	4.3	8.0	5.9	18	9
7/17/03 (Highwood)									
Big Coulee, Suppression	2625	3.25	WCT	17	1.5	8.1	5.6	6	5
T 20 N R 9E Sec 10NW	2625	3.25	EB	58	2.5	7.8	4.5	22	18
8/22/03 (Highwood)									
Big Coulee, Suppression	1312	1.75	WCT	2	7.5	7.6	7.6	2	1

Stream, Survey Type Legal	Date (Drainage)	Length (feet)	Hours Sampled	Species	N	Total Length (inches) Min	Max	Avg	CPUE (1000 feet)	CPUE (hour)
T 20N R 9E Sec 10	8/25-26/03 (Highwood)	1312	1.75	EB	13	3.3	9.1	7.6	10	7
Big Coulee, Suppression		--	3.18	WCT	67	2.8	7.6	4.0	--	21
T 20N R 9E Sec 10	8/26-27/03 (Highwood)	--	3.18	EB	19	3.0	8.1	5.5	--	6
Big Coulee, Suppression		--	1.73	WCT	47	1.4	8.2	5.3	--	27
T 20N R 9E Sec 10	8/27/03 (Highwood)									
Big Coulee, Suppression		--	0.80	WCT	10	6.3	8.6	7.7	--	13
T 20N R 9E Sec 10	8/27/03 (Highwood)									
Big Coulee, Trib., Suppression		2953	3.25	EB	41	3.7	7.3	5.4	14	13
T 20N R 9E Sec 10	7/16/03 (Highwood)									
Big Coulee, Trib., Suppression		2953	1.43	EB	5	5.1	6.9	5.9	2	3
T 20N R 9E Sec 10	8/25/03 (Highwood)									
Big Coulee, Mark - Movement		1286	0.73	EB	215	3.4	9.1	6.1	167	294
T 19N R 9E Sec 10	10/9/03	1286	0.73	LL	1	7.3	7.3	7.3	1	1

Stream, Survey Type Legal Date (Drainage)	Length (feet)	Hours Sampled	Species	N	Total Length (inches) Min	Max	Avg	CPUE (1000 feet)	CPUE (hour)
(Highwood)									
Calf Cr., Population Estimate	492	0.65	EB	8	3.2	5.4	4.6	16	12
T 13N R 6E Sec 34SW	492	0.65	RB	78	2.8	12.2	4.7	120	91
10/6/03 (Smith)									
Carpenter Cr., Spawning Survey	656	0.58	WCT	17	4.5	7.1	5.6	26	29
T 14N R 8E Sec 15									
6/3/03 (Belt)									
Carpenter Cr., Spawning Survey	328	0.69	WCT	19	3.0	7.0	5.1	58	28
T 14N R 8E Sec 15									
6/17/03 (Belt)									
Carpenter Cr., Spawning Survey	--	0.45	WCT	24	2.8	6.8	4.8	--	54
T 14N R 8E Sec 15SE									
6/25/03 (Belt)									
Carpenter Cr., Disease Sample	328	0.25	WCT	30	4.3	7.5	6.0	91	121
T 14N R 8E Sec 15									
8/26/03 (Belt)									
Chamberlain Cr., Lower, Population Estimate	328	0.37	WCT	24	2.5	9.4	5.7	52	45
T 13N R 8E Sec 2SE	328	0.37	EB	6	4.3	7.7	6.1	18	16
8/20/03 (Belt)									
Chamberlain Cr., Upper, Population Estimate	492	0.00	WCT	51	2.4	9.7	5.7	98	--

Stream, Survey Type Legal Date (Drainage)	Length (feet)	Hours Sampled	Species	N	Min	Total Length (inches) Max	Avg	CPUE (1000 feet)	CPUE (hour)
T 13N R 8E Sec 2SE 8/20/03 (Belt)									
Cottonwood Cr., W. Fk., Transfer T 8N R 7E Sec 14, 23 7/29/03 (Smith)	2461	1.87	WCT	203	55<6"	and	25>6"	82	109
Cottonwood Cr., Lower, Suppression T 19N R 10E Sec 5 8/11-12/03 (Arrow)	3310	0.00	WCT	80	1.5	11.0	5.0	24	--
Cottonwood Cr., Trib., Suppression T 19N R 10E Sec 5 8/11-12/03 (Arrow)	--	--	WCT	78	1.4	8.7	4.0	--	--
Cottonwood Cr., Below Falls, Suppression T 19N R 10E Sec 5 8/12/03 (Arrow)	--	1.24	WCT	43	3.3	9.6	5.0	--	35
Cottonwood Cr., Sec. 1 Above Falls, Suppression T 19N R 10E Sec 5 8/13/03 (Arrow)	--	0.58	WCT	57	1.8	9.1	4.7	--	98
Cottonwood Cr., Sec. 2,3 Above Falls, Suppression T 19N R 10E Sec 5 8/13/03	-- --	1.10 1.10	WCT EB	95 3	1.8 5.0	8.3 5.9	4.5 5.5	-- --	86 3

Stream, Survey Type Legal Date (Drainage) (Arrow)	Length (feet)	Hours Sampled	Species	N	Total Length (inches) Min	 Max	 Avg	CPUE (1000 feet)	CPUE (hour)
Cottonwood Cr., Sec. 4 Above Falls, Suppression	--	0.58	WCT	62	1.7	6.8	4.0	--	107
T 19N R 10E Sec 5	--	0.58	EB	1	5.8	5.8	5.8	--	2
8/13/03 (Arrow)									
Cottonwood Cr., Sec. 5 Above Falls, Suppression	0	0.88	WCT	43	3.0	7.5	4.6	--	49
T 19N R 10E Sec 5	0	0.88	EB	2	4.8	5.7	5.3	--	2
8/14/03 (Arrow)									
Cottonwood Cr., Sec. 6,7 Above Falls, Suppression	--	2.08	WCT	117	2.8	9.8	4.5	--	56
T 19N R 10 Sec 5 8/14/03 (Arrow)									
Cottonwood Cr., Sec. 8 Above Falls, Suppression	--	2.00	WCT	224	2.2	9.4	4.7	--	112
T 19N R 10E Sec 5 8/18/03 (Arrow)									
Cottonwood Cr., Last Sec. Above Falls, Suppression	4331	6.82	EB	2	5.1	5.7	5.4	0.46	0.29
T 19N R 10E Sec 5 9/29-10/1/03 (Arrow)									
Crawford Cr., Mark - Movement	262	0.60	WCT	13	3.9	10.4	6.5	50	22
T 14N R 7E Sec 1	262	0.60	EB	1	7.6	7.6	7.6	4	2
5/8/03 (Belt)	262	0.60	RB	2	5.6	7.0	6.3	8	3

Stream, Survey Type Legal Date (Drainage)	Length (feet)	Hours Sampled	Species	N	Total Length (inches) Min	Max	Avg	CPUE (1000 feet)	CPUE (hour)
Crawford Cr., Genetics	787	1.30	WCT	52	2.4	8.0	4.9	66	40
T 14N R 7E Sec 1									
6/11/03 (Belt)									
Deadhorse Cr., Upper, Genetics	492	0.81	WCT	18	4.6	7.5	6.4	37	22
T 11N R 10E									
6/13/03 (Judith)									
Deep Cr., N. Fk., Transfer	1312	4.57	WCT	138	2.9	10.4	8.0	105	30
T 15N R 5E Sec 19E									
7/7-8/03 (Smith)									
Dry Wolf Cr., Population Estimate	492	0.81	WCT	54	5.5	5.7	5.6	100	61
T 14N R 9E Sec 13NE	492	0.81	EB	46	2.4	8.2	4.9	81	50
9/25/03 (Judith)									
Dry Wolf Cr., Genetics	787	0.54	WCT	26	3.5	9.7	6.6	33	48
T 14N R 9E Sec 27									
9/25/03 (Judith)									
Graveyard Gulch, Disease	492	0.47	WCT	43	4.6	9.0	6.7	87	92
T 4N R 7E Sec 25	492	0.47	EB	22	5.0	9.0	7.0	45	47
8/26/03 (Belt)									
Hall Cr., Genetics	7920	--	WCT	10	Range	1.2" to	1.6"	1	--
T 30N R 13W Sec 23NE, 24NW									

Stream, Survey Type Legal Date (Drainage)	Length (feet)	Hours Sampled	Species	N	Total Length (inches) Min	Max	Avg	CPUE (1000 feet)	CPUE (hour)
7/21/03 (Two Medicine)									
Harley Cr., Genetics	492	0.28	WCT	25	3.2	8.9	5.6	51	90
T 14N R 7E Sec 30NW	492	0.28	EB	16	4.4	7.4	6.3	33	57
6/25/03 (Belt)									
Harrison Cr., W. Fk., Genetics	656	0.39	WCT	25	2.4	6.5	3.6	38	65
T 12N R 9E Sec 17NE 8/6/03 (Judith)									
Harrison Cr., S. Fk., Genetics	656	1.29	WCT	26	3.3	8.7	5.9	40	20
T 12N R 9E Sec 17NE 8/7/03 (Judith)									
Harrison Cr., Population Estimate	509	0.64	WCT	48	2.4	8.7	5.0	55	44
T 12N R 9E Sec 17NE	509	1.26	EB	1	6.5	6.5	6.5	2	1
8/6/03 (Judith)									
Jumping Cr., Relative Abundance	328	0.55	EB	22	2.8	7.2	5.7	67	40
T 12N R 7E Sec 25, T 12N R 8E Sec 30 6/25/03 (Smith)									
Jumping Cr., Upper, Relative Abundance	1640	0.60	WCT	51	Range	2" to 6"		31	84
T 12N R 8E Sec 18NE 7/8/03 (Smith)									

Stream, Survey Type Legal Date (Drainage)	Length (feet)	Hours Sampled	Species	N	Total Length (inches) Min	Max	Avg	CPUE (1000 feet)	CPUE (hour)
Lake Cr., Below Crater Lake, Relative Abundance	--	0.13	HYB	1	--	--	--	--	7.6
T 11N R 7E Sec 36									
8/7/03 (Smith)									
Little Belt Cr., M. Fk., Suppression	1640	2.42	WCT	25	2.2	9.1	4.3	15	10
T 19N R 9E Sec 18	1640	2.42	EB	44	4.1	10.7	6.5	27	18
7/1/03 (Belt)									
Little Belt Cr., M. Fk., Suppression	--	1.61	WCT	107	0.5	9.4	5.4	--	66
T 19N R 9E Sec 18	--	1.61	EB	10	5.8	7.9	6.9	--	6
8/18/03 (Belt)									
Little Belt Cr., Upper, M. Fk., Suppression	--	1.65	WCT	69	2.0	8.7	4.7	--	42
T 19N R 9E Sec 18	--	1.65	EB	33	4.5	8.3	6.0	--	20
8/19/03 (Belt)									
Logging Cr., EB Removal	1896	2.83	WCT	33	2.2	9.7	6.7	17	12
T 15N R 5E Sec 23	1896	2.83	EB	65	1.3	9.9	6.3	34	23
6/26/03 (Belt)									
Logging Cr., Upper, Relative Abundance	131	0.83	WCT	10	3.7	10.0	6.4	76	12
T 15N R 5E Sec 26									
6/26/03 (Belt)									
Midvale Cr., Disease/Population Estimate	492	0.30	WCT	5	4.8	6.7	5.8	8	13
T 31N R 13W Sec 14									

Stream, Survey Type Legal Date (Drainage)	Length (feet)	Hours Sampled	Species	N	Min	Total Length (inches) Max	Avg	CPUE (1000 feet)	CPUE (hour)
9/9/03 (Two Medicine)									
Palisades Cr., Relative Abundance	--	0.26	WCT	19	1.0	10.0	6.0	--	73
T 13N R 8E Sec 3	--	0.26	RB	1	7.7	7.7	7.7	--	4
6/19/03 (Belt)									
Petty Cr., Transfer	--	0.11	WCT	9	5.5	8.5	7.2	--	81
T 18N R 8W Sec 24									
7/9/03 (Sun)									
Shonkin Cr., Relative Abundance	--	0.11	EB	9	2.8	8.0	5.5	--	81
T 20N R 10E Sec 19									
9/2/03 (Shonkin)									
Tenderfoot, S. Fk., Genetics/Population Estimate	328	0.55	WCT	20	5.3	8.0	6.7	37	22
T 13N R 5E Sec 4									
8/21/03 (Smith)									
Weatherwax, Cr., Genetics/Population Estimate	541	0.40	WCT	29	3.2	7.7	5.2	26	35
T 13N R 8E Sec 3	541	0.40	EB	1	5.9	5.9	5.9	2	2
8/5/03 (Judith)									
Whiterock Cr., Transfer	1148	0.61	WCT	54	0.0	0.0	0.0	47	88
T 29N R 12W Sec 3									
9/30/03 (Two Medicine)									

Appendix 7. Results of Region 4 genetics testing results received in 2003. Samples were collected by MFWP, USFS and USFWS.

Stream	Drainage	Legal	# Fish	Year Collected	Date Reported	Test	Results
Cottonwood Cr. (Highwood))	Arrow	T 19N R 10E Sec 5	15	2001	03/17/03	PCR	100% WCT
Bender Cr.	Belt	T 15N R 8E Sec 23SE	25	2002	03/17/03	PCR	100% WCT
Crawford Cr.	Belt	T 14N R 7E Sec 11SE	10	2001	03/17/03	PCR	100% WCT
James Cr.	Belt	T 14N R 7E Sec 6NE	10	2001	03/17/03	PCR	95.7% WCT x 4.3% RB
Carpenter Cr.	Belt	T 14N R 8E Sec 15SE	10	2000	03/21/03	Alloz	100% WCT
Graveyard Gulch	Belt	T 14N R 7E Sec 25SE	10	1999	03/21/03	Alloz	100% WCT
Graveyard Gulch	Belt	T 14N R 7E Sec 25SE	15	1999	03/21/03	Alloz	100% WCT
Little Belt Cr, M. Fk.	Belt	T 19N R 9E Sec 18E	15	2001	06/03/03	PCR	100% WCT
Lost Cr.	Belt	T 16N R 9E Sec 29	49	2002	07/01/03	PCR	94.5% WCT x 5.5 YCT
Half Moon Cr	Flatwillow	T 12N R 19E Sec 14NE	25	2002	06/03/03	PCR	100% WCT
Big Coulee Cr.	Highwood	T 20N R 8E Sec 9E	40	2002	06/03/03	PCR	100% WCT
Running Wolf Cr., N. Fk.	Judith	T 14N R 10E Sec 16S	25	2001	01/06/03	PCR	100% WCT
Russian Cr. (trib.)	Judith	T 11N R 10E Sec 2	25	2002	1/6/2003	PCR	97.5% WCT x 2% RB x 0.5 YCT
Elk Cr.	Judith	T 13N R 10E Sec 5	5	2002	03/17/03	PCR	98.2% WCT x 1.8% RB
Cottonwood Cr., W. Fk.	Judith	T 12N R 18E Sec 10	25	2002	07/01/03	PCR	100% WCT
Skelly Gulch	Missouri	T 11N R 6W Sec 14	39	2002	03/17/03	PCR	100% WCT
Elkhorn Cr.	Missouri	T 14N R 2W Sec 26	46	2002	03/27/03	PCR	87.6% WCT x 12.4% RB
Black Butte Cr.	Smith	T 12N R 6E Sec 27NE	5	2000	03/21/03	Alloz	70% WCT x 30% YCT
Cottonwood Cr.	Smith	T 8N R 7E Sec 22	40	2000	03/21/03	Alloz	100% WCT
Deep Cr, N. Fk.	Smith	T 15N R 5E Sec 19NE	5	2000	03/21/03	Alloz	100% WCT
Twin Cabins (Balsinger trib.)	Smith	T 14N R 6E Sec 16NE	10	2001	6/3/2003	PCR	88% WCT x 10 YCT x 2% RB
Lee Cr., E. Fk	St. Mary	T 37N R 15W Sec 14	25	2002	07/01/03	PCR	97.7% WCT x 2.3% RB
Green Gulch	Teton	T 24N R 9W Sec 10	20	2000	6/3/2003	PCR	100% WCT
Sydney Cr. (above barrier)	Two Medicine	T 29N R 12W Sec 20	25	2001	03/17/03	PCR	100% WCT

RB = Rainbow trout; YCT = Yellowstone cutthroat trout; WCT = Westslope cutthroat trout

Appendix 8. Genetic samples taken by MFWP and USFS personnel in 2003.

Stream	Drainage	Legal	# Fish	Collect	Report Date	Test Type
Crawford Cr.	Belt	T 14N R 7E Sec 11	15	6/11/2003	FY 2004	PCR
Crawford Cr.	Belt	T 14N R 7E Sec 11	25	6/11/2003	FY 2004	PCR
Harley Cr.	Belt	T 14N R 7E Sec 25	25	06/25/03	FY 2004	PCR
Palisades	Belt	T 13N R 19E Sec 13	10	06/19/03	FY 2004	PCR
Big Hill Cr.	Judith	T 11N R 10E Sec 9N	33	6/24/2003	FY 2004	PCR
Big Spring Cr., E. Fk.	Judith	T 12N R 19E Sec 4	30	09/23/03	Archive	PCR
Deadhorse Cr., Trib	Judith	T 11N R 10E Sec 13	18	06/13/03	FY 2004	PCR
Dry Wolf Cr.	Judith	T 14N R 9E Sec 27NW	26	10/28/03	Archive	PCR
Harrison Cr.	Judith	T 12N R 9E Sec 17NE	26	08/07/03	FY 2004	PCR
Harrison Cr.	Judith	T 12N R 9E Sec 17NE	25	08/06/03	Archive	PCR
Judith R., S. Fk.	Judith	T 11N R 11E Sec 4E	25	06/23/03	FY 2004	Alloz.
Judith R., S. Fk.	Judith	T 11N R 11E Sec 18	25	06/23/03	FY 2004	Alloz.
Weatherwax Cr.	Judith	T 12N R 9E Sec 5	25	08/05/03	FY 2004	PCR
Yogo Cr.	Judith	T 13N R 10E Sec 6NW	13	7/30/03	FY 2004	PCR
Tenderfoot Cr., S. Fk.	Smith	T 13N R 5E Sec 4	20	08/21/03	FY 2004	PCR
Green Gulch (lower)	Teton	T 24N R 9W Sec 4	25	07/17/03	FY 2004	PCR
Green Gulch (upper)	Teton	T 24N R 9W Sec 22	10	08/15/03	FY 2004	PCR
Dupuyer Cr., N. Fk.	Two Medicine	T 27N R 9W S 29	25	7/16/03	FY 2004	PCR
Dupuyer Cr., M. Fk.	Two Medicine	T 27N R 9W Sec 26	7	7/21/2003	FY 2004	PCR
Dupuyer Cr., S. Fk.	Two Medicine	T 27N R 9W Sec 35	25	07/22/03	FY 2004	PCR
Dupuyer Cr., S. Fk.	Two Medicine	T 27N R 9W Sec 3	25	07/22/03	FY 2004	PCR
Hall Cr.	Two Medicine	T 30N R 13W Sec 2NW	10	07/21/03	FY 2004	PCR

Appendix 9. Specific conductance and temperature for streams sampled in 2003. Samples were collected by MFWP and the USFS.

Stream name	Drainage	Date Sampled	Cond. (µS/cm)	Temp. (˚F)
Cottonwood Cr., (lower)	Arrow	8/11/03	121	61
Cottonwood Cr., (trib.)	Arrow	8/12/03	91	59
Cottonwood Cr., (below falls)	Arrow	8/12/03	106	61
Cottonwood Cr., (sec. 1 above falls)	Arrow	8/13/03	150	63
Cottonwood Cr., (sec. 4 above falls)	Arrow	8/13/03	150	63
Cottonwood Cr., (sec. 8 above falls)	Arrow	8/18/03	121	57
Cottonwood Cr., (last sec. above falls)	Arrow	9/29/03	106	42
Carpenter Cr.	Belt	6/3/03	50	41
Carpenter Cr.	Belt	6/17/03	60	42
Carpenter Cr.	Belt	6/25/03	60	40
Carpenter Cr.	Belt	8/26/03	80	54
Chamberlain Cr., (lower)	Belt	8/20/03	150	51
Chamberlain Cr., (upper)	Belt	8/20/03	106	52
Chamberlain Cr., (high)	Belt	8/21/03	140	51
Crawford Cr.	Belt	5/8/03	30	38
Crawford Cr.	Belt	6/11/03	61	50
Graveyard Gulch	Belt	8/26/03	136	53
Harley Cr.	Belt	6/25/03	40	44
Little Belt Cr., M. Fk.	Belt	7/1/03	106	49
Little Belt Cr., M. Fk.	Belt	8/18/03	160	53
Little Belt Cr., Upper, M. Fk.	Belt	8/19/03	160	52
Logging Cr.	Belt	6/26/03	121	43
Palisades Cr.	Belt	6/19/03	30	47
Big Coulee Cr., (above blasted barrier)	Highwood	5/22/03	76	44
Big Coulee Cr., (above blasted barrier)	Highwood	6/10/03	91	50
Big Coulee Cr., (above blasted barrier)	Highwood	6/19/03	91	52
Big Coulee Cr., (below blasted barrier)	Highwood	6/30/03	121	59
Big Coulee Cr., (above blasted barrier)	Highwood	7/17/03	152	59
Big Coulee Cr., (above blasted barrier)	Highwood	8/22/03	167	58
Big Coulee Cr., (section 1)	Highwood	8/25/03	136	54
Big Coulee Cr., (section 1)	Highwood	8/26/03	136	53
Big Coulee Cr., (section 2)	Highwood	8/26/03	136	54
Big Coulee Cr., (section 2)	Highwood	8/27/03	167	54
Big Coulee Cr., (section 3)	Highwood	8/27/03	91	53
Big Coulee Cr., (section 4)	Highwood	8/28/03	90	52
Big Coulee Cr., (trib.)	Highwood	7/16/03	197	57
Big Coulee Cr., (trib.)	Highwood	8/25/03	240	56
Big Coulee Cr., (above road)	Highwood	10/9/03	210	46
Deadhorse Cr.	Judith	6/13/03	121	64
Dry Wolf Cr.	Judith	9/25/03	106	46
Harrison Cr., W. Fk.	Judith	8/6/03	76	52
Harrison Cr., S. Fk.	Judith	8/7/03	121	
Harrison Cr.	Judith	8/6/03	91	52
Weatherwax, Cr.	Judith	8/5/03	182	46
Lake Cr.	Smith	8/7/03	400	64
Calf Cr.	Smith	10/6/03	76	44
Cottonwood Cr., W. Fk.	Smith	7/29/03	140	49
Deep Cr., N. Fk.	Smith	7/7/03	167	58

Stream name	Drainage	Date Sampled	Cond. (µS/cm)	Temp. (˚F)
Jumping Cr., Upper	Smith	7/8/03	190	45
Petty Cr.	Sun	7/9/03	260	43
Midvale Cr.	Two Medicine	9/9/03	120	46
Midvale Cr.	Two Medicine	9/9/03	120	46
Whiterock Cr.	Two Medicine	9/30/03	160	38

*TDS (Total Dissolved Solids) measurements collected in the field were converted to specific conductance using the formula Cond. = TDS/0.66